SCIENTIFIC AMERICAN

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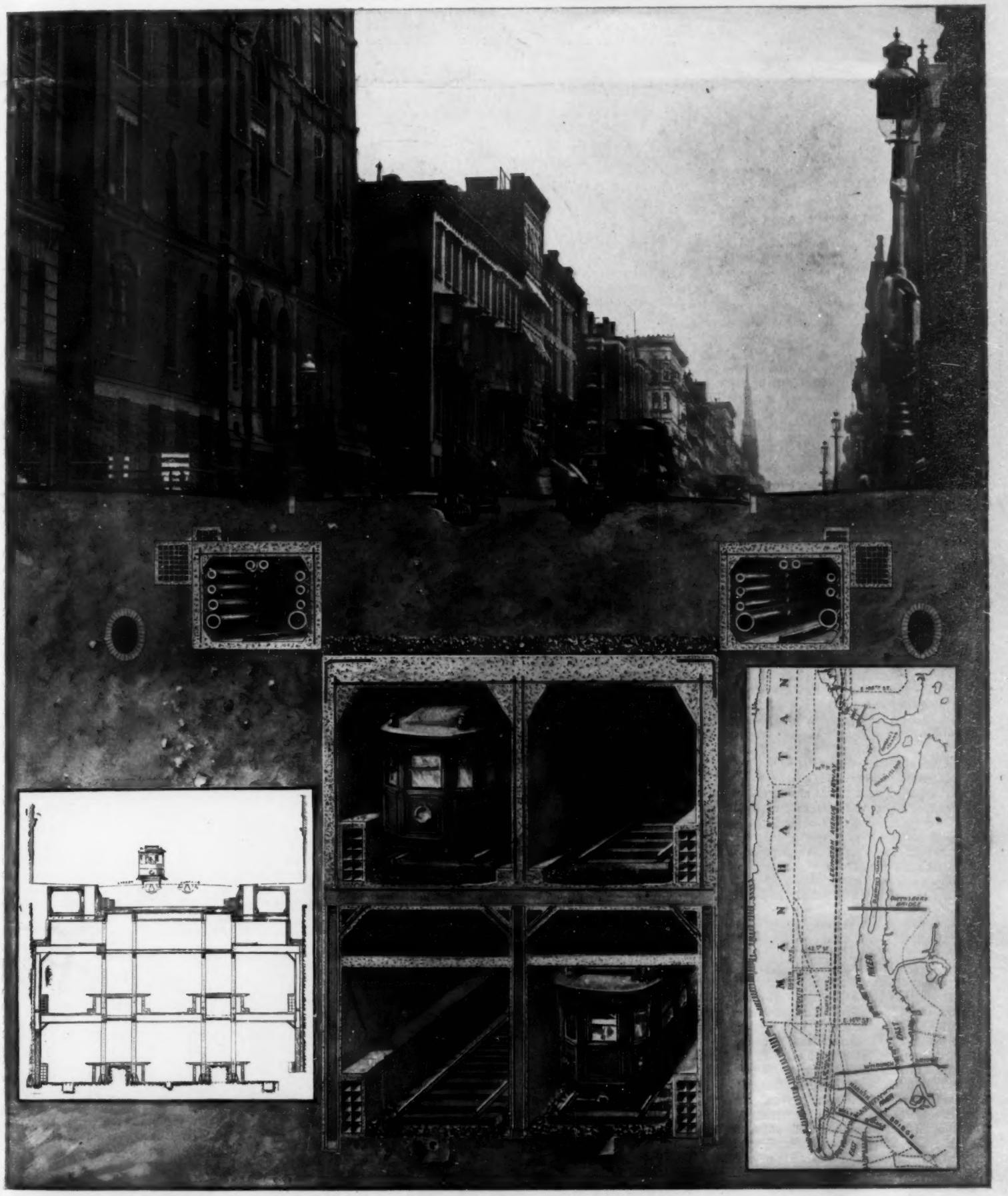

The 86th Street station.

A sectional view through the proposed Lexington Avenue subway at 80th Street.

Map of the Lexington Avenue subway.

The locals will run on the upper, the express trains on the lower deck. If the proposals of the Interborough Company are carried through, the capacity of the elevated roads will be doubled in two years and that of the subways in five years' time.

A GREAT RAPID TRANSIT SYSTEM FOR A GREAT CITY.—[See page 478.]

SCIENTIFIC AMERICAN

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NEW YORK, SATURDAY, DECEMBER 17th, 1910.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

THE SECRETARY OF THE NAVY'S REPORT.

THE annual report of Secretary of the Navy Meyer is a document of unusual interest. It is marked by the practical business-like qualities, the clear thinking and clean-cut discussion of his subject, which usually characterize the utterances of the present very able head of the Navy Department. The SCIENTIFIC AMERICAN is anxious to avoid giving the impression that in strongly opposing a certain part of the Secretary's reforms, it has failed to recognize the general excellence of the others; and our perusal of the report before us confirms our belief that the total outcome of the upheaval which resulted from Mr. Meyer's accession to office will be one of permanent and recognized value to the great department over which he presides.

The most important and sensational feature of the report, the one which will carry no little consternation into that coterie of political men who have used the naval institutions as political bait, is the recommendation that Congress authorize the abandonment of no less than eight naval stations, namely, those of New Orleans, Pensacola, San Juan in Porto Rico, Port Royal, New London, Sacketts Harbor, Culebra in Porto Rico, and Cavite in the Philippine Islands. Mr. Meyer says that the average annual cost of maintaining these yards for the last five years has been $1,672,675, and that the amount of useful work which has been done at any of them has been very small. Most important also is the recommendation that more colliers and other auxiliaries and enlarged docking facilities be provided. It would seem as though the lesson taught by the cruise of our battleship fleet around the world, when it was almost entirely dependent upon foreign merchant ships for its coal supply, has not even yet been fully appreciated.

The programme for new construction offered by the Secretary calls for two battleships, one collier, one gunboat, one river gunboat, two seagoing tugs, two submarines, and one submarine tender.

Nowhere has the influence of Mr. Meyer been shown to more marked effect than in the direction of economy, particularly in the consumption of coal and other leading supplies. As a result, the ability of the fleet to keep at sea has been increased about 15 per cent, and the average cruising speed has been raised about 20 per cent. Furthermore, the amount of supplies used on the vessels has been reduced about 20 per cent, and from this source alone a saving of about $1,500,000 is looked for.

In speaking of the results obtained under the naval reorganization plan, which has been on trial for one year, the Secretary says the work accomplished and the improvements resulting from the advice of the aids have been extremely gratifying. The aid for operations has worked out a reorganization of the battleship fleet and torpedo vessels which has brought about a remarkably greater efficiency. It has also produced a more even amount of repair work at navy yards. This is of importance, as a greater economy ensues, and it keeps a more uniform number of good workmen employed. The work of the general board, war college, and office of naval intelligence, has been better co-ordinated, so that our war plans and strategic studies are up-to-date. The aid for material, says the Secretary, has been of most assistance and value in scrutinizing requests for repairs on vessels. Repairs of an extended nature are taken up with the general board and the division of inspection, and it is believed that this method is preventing such useless and unwarrantable expenditures as have been made in the past. The aid for inspection has expedited repair work, and advised what older vessels should not be further repaired. He has also restrained the tendency to spend too much money in modernizing vessels of little military value. The aid for personnel has been concerned with recommendations on the subject of details of officers of a higher grade, matters affecting the enlisted men, the naval academy, discipline and legislation affecting personnel, and matters pertaining to the naval militia. To further reduce the amount of routine papers, Mr. Meyer thinks it advisable to authorize the aids to sign detail instructions to carry out the general instructions from the Secretary.

In recommending the abandonment of the navy yards at New Orleans and Pensacola, the Secretary affirms that the Gulf coast and the Southern Atlantic coast are best defended by the occupation of Guantanamo naval station in Cuba. In case of hostilities on the Atlantic side, our battle fleet will be placed in the Caribbean Sea. Guantanamo Bay can accommodate and anchor thirty-five battleships in the harbor, and sixteen more in the outer harbor if necessary. It is proposed to transfer the floating dock at New Orleans to Guantanamo, put up inexpensive shop buildings there, and transfer from New Orleans and Pensacola navy yards such equipment as may be desired, the whole to be done at an expense of about $400,000. Key West alone should be retained as a naval station on the Gulf. It would make an excellent base of supply for the fleet in the Caribbean, and it would admirably supplement the naval base at Guantanamo.

The Secretary does not think it advisable to maintain a battle fleet in the Pacific Ocean, not at least until the Panama Canal is opened. It would cost $4,000,000 a year more to maintain a fleet in the Pacific than it does in the Atlantic, and the docks on that side are not adequate to take care of a large fleet of sixteen or more battleships, with their auxiliaries.

We are much pleased to see that the flight made by Eugene Ely from the deck of the scout "Birmingham" to the shore has convinced Mr. Meyer that aviation is destined to perform some part in the naval warfare of the future, probably in the field of scouting. A scout which could not pierce the enemy's line could dispatch an aeroplane, and gather the needed information. The Secretary considers it to be necessary in the near future to equip all scouts with one or more aeroplanes, and he, therefore, recommends that the sum of $25,000 be appropriated for future experimental work.

THE INTERBOROUGH'S ATTITUDE TO THE PUBLIC.

THE Interborough Company has its own short-sighted policy to thank for the fact that its ambitious and liberal proposal to build the tri-borough system of subways, together with others of its own suggestion, has not been received by the public with that enthusiasm which this stupendous project deserves. The complaint of Commissioner Eustis that the attitude of the Interborough Company has been one of cynical disregard of the convenience of the traveling public, is only too well founded. Instead of loyally co-operating in carrying out the very reasonable demands of the Public Service Commission for improved service during the rush hours, the company has preferred the policy either of evasion or of direct disobedience; and even where a more liberal service has been provided, extra trains have been withdrawn, apparently as soon as the operating staff considered that the wrath of the public had been appeased and the vigilance of the city officials relaxed. Now, if this charge of the Commissioner is true—and the wretched experience of the patrons of the road bears out the charge—this great company, instead of recognizing its splendid opportunity for winning and holding the public regard, has chosen to follow a picayune policy, which has been as derogatory to the dignity of the company as it has been exasperating to the traveling public. Had the attitude of the Interborough been other than it was, the chances of the present proposals being accepted would be greater than they are. Personally, we believe that the latest plans of the Interborough are the best possible solution of the rapid-transit problem. These proposals are liberal, and appear to have been based upon a broad-minded survey of the whole situation. It is evident that some new and very potent influence has been introduced into the councils of the company. Whatever this influence is, or from whatever source it may spring, let us hope that it marks a healthy departure from the old policy of evasion, cheeseparing, and irritating, if not insulting, disregard of the city's interests.

A more liberal attitude would be entirely in keeping with that new corporation policy which is one of the most encouraging results that have grown out of the recent nation-wide agitation on the subject of the relations between the public and the big corporations. This policy is based upon the recognition of the fact that there is everything to gain and nothing to lose by the cultivation on the part of the great transportation companies, whether steam or electric, of the confidence and esteem of the public whom they serve.

LONGER PIERS FOR ATLANTIC LINERS.

THERE are two ocean liners under construction and a third ordered, which are to have an extreme length of nearly nine hundred feet; and there is one ship now being built that is to be at least nine hundred feet long, if not more. In view of these facts, does it not seem rather absurd that the port of New York, at which all of these ships will call, possesses no piers on Manhattan Island of a greater length than 825 feet? South Brooklyn, it is true, has a system of piers under way which, if the original plans are followed, will be from twelve hundred to eighteen hundred feet in length; but South Brooklyn is a center for the shipment of freight, not of passengers, and the huge vessels which are now under construction for the New York trade are pre-eminently passenger-carrying ships.

If the "Olympic" or "Titanic" were to call at New York under existing conditions, and warp alongside one of the 800-foot Chelsea piers, the stern of the vessel, if an allowance of eight or ten feet were made for clearance of the stem head at the bulkhead line, must extend about 80 feet out into the fairway of the North River. Even the new Cunard boat, which will have the advantage of mooring to a pier that is 25 feet longer, will thrust 65 feet of her huge bulk out into the channel. The Hamburg-American liner "Europa," with her reputed length of 900 feet or over, will encroach upon the navigable waters to the extent of considerably over 100 feet on the New Jersey side, where she will lie.

Now, the obtrusion of so much of the bulk of these vessels upon one of the busiest waterways in the world, cannot be considered for a moment. The risks, both to the ships themselves and to traffic up and down the river, would be altogether prohibitive. Moreover, the projecting vessel would prove a most serious obstacle to the docking of other liners that have their berthing places adjacent to those of the vessels in question. Various expedients have been proposed for the protection of the ships themselves, such as the mooring of heavy booms, or even of lighters, on each side of the projecting stern; but even were this done, the danger of damage to propellers and rudders from other liners when making a landing, would be too great to be considered for a moment.

Obviously, the solution of the dilemma lies in increasing the pier length, either by excavation into the land or by extension into the channel, or by both means. If the increased length were taken from the shore, it would be necessary to reduce the workable width of West Street to just that extent; and, although this thoroughfare is of unusual width, we question whether a proper consideration of the future growth of the traffic of the city would countenance any such encroachment on the land. The only alternative would be to extend the piers farther into the channel.

Now, to such a course the War Department has hitherto been most strongly opposed. This Department has the over-sight of all harbor and river facilities, being intrusted with the most important duty of safeguarding the interests of the public at large against the encroachments of individuals or corporations. In fulfilling this duty, the Department has shown great fidelity, and, as a rule, it has used a wise discretion. There have been times, however, when the officials have seemed to err on the side of an over-zealous conservatism; and we believe that the situation of New York affords an instance of this misdirected zeal.

The reason adduced by the Department for refusing to sanction pier extension into the river is that the traffic upon the North River is growing so fast, that the subtraction of one or two hundred feet from its clear width between pierhead lines would be seriously felt, if not just now, certainly in the near future. We must confess, however, that we fail to see how the loss of even two hundred feet from a fairway that is from twenty-eight hundred to thirty-five hundred feet in width, can have any serious effect upon the freedom of navigation. Compared with many other great ports of the world, that part of the thoroughfare which lies between Manhattan and the Jersey shore is unusually spacious. It is not clear that any immediate or prospective congestion of shipping is to be feared. The larger shipping keeps to the center of the river; the smaller craft, as a rule, hug the pierhead line; and the proposed encroachment would still leave abundance of room for navigation, especially if laws were passed calling for a lower rate of speed when under way.

ELECTRICITY.

The Austrian government has ordered all vessels carrying passengers to and from Austrian ports, and making voyages beyond Gibraltar or Aden, to be equipped with wireless telegraph apparatus having a minimum range of 100 miles.

By using tantalum lamps for car lighting, the Chicago Railway Company finds that it can save five cents a day per car. A thousand cars have been equipped with tantalum lamps, and will save the company $18,000 a year on this basis. The company expects to equip all of its cars in this way, and effect a saving of over $35,000 a year.

The success of the lectures on illuminating engineering given at Johns Hopkins University following the meeting of the Society of Illuminating Engineers at Baltimore this year, has induced the Consolidated Gas, Electric Light, and Power Company of Baltimore to arrange for a series of ten lectures at the university for the benefit of its employees.

The western suburban lines of Paris are to be electrified. Separate tracks are to be provided for the trunk lines, and the suburban lines will be divided into three zones, each with its own set of trains that do not stop in inner zones. By this method the number of trains will be reduced, and the service in the first zone increased to a three-minute headway.

An active campaign is about to be begun by the Electric Vehicle Association of America, to advertise and further the development of electric vehicles. The success of this type of vehicle in recent years has been very large, and is coming to be recognized as the best type of machine for use in cities where speed laws prohibit fast traveling, and power for charging the batteries is always at hand.

A simple lighting system for automobiles has recently been provided, in which the current is generated by a 6-volt dynamo belt connected to the engine. A storage battery is used in connection with the dynamo to furnish current when the engine stops or when it is running at low speed. A regulator is used to maintain a constant voltage. As this voltage is below that of the storage battery when fully charged, there is no danger of overcharging the battery. A switch is provided for turning down the lights one-third when desired.

In order to illustrate the possibilities of electric light for exterior illuminating, the Denver Gas and Electric Company has outlined its building with electric lamps. The work has been done very cleverly and artistically, so that the lighting does not merely represent an outline of the building, but emphasizes the decoration of the building, giving it at night an exceedingly attractive appearance. Thirteen thousand electric lamps are thus used, and their combined candle-power is 200,000.

The Illinois Central Railroad is using the telephone dispatching system on more than two thousand miles of its road. Recently the line between Paducah and Central City, Ky., has been so equipped. Aside from the regular telephone stations, there are a number of way stations placed at sidings and other points, where no regular operators are stationed. Conductors of freight trains are provided with portable telephone sets, which may be plugged into the line at these way stations, thus bringing them into direct touch with the train dispatcher. In order to make sure that the instruments are in perfect condition, they are not given to the conductor until just before he starts out on a trip, and are taken in again immediately on his return.

An interesting apparatus for operating street-railway switches has been invented by a Belgian engineer. The switch is thrown by means of electro-magnets, controlled by commutators on the trolley wires, placed at a distance of about 15 yards from the switch. One of the commutators will throw the switch to the right, and the other to the left. If the motorman desires to use the right-hand track, he shuts off the power when passing the commutator giving access to the left-hand line, and *vice versa*.

When the mercury vapor lamp was invented, and it was discovered that the light was lacking in red rays, it was thought by the uninitiated that the light could be improved by the use of red glass about the lamp. This, of course, was impossible, for the reason that red glass acts merely as a filter of the light passing through it, cutting off all rays except the red. As there were no red rays in the mercury-vapor lamp, the effect of putting red glass around it was to cut off practically all the light. Recently, Dr. Peter Cooper Hewitt, the inventor of the lamp, has devised a means for adding red rays to the light emitted by the lamp. He uses a reflector coated with fluorescent material, which is of such a character as to transform the wave length of certain rays falling upon it, so that red rays are reflected. The fluorescent material is painted on sheets of cardboard, which may be removed from the reflector frame when they show any deterioration, and be replaced with fresh sheets.

AERONAUTICS

Jacques Faure, the famous aeronaut, who died recently, was the champion balloonist of France. He was a cousin of Hubert Latham, and did much to help the latter in his work.

Legagneux, the well-known French aviator, is reported to have broken the world's altitude record on the 9th instant with a Blériot monoplane. The height reached was 10,499 feet.

Garros, in a Blériot monoplane, had a bad fall at Memphis, Tenn., on December 3rd. He dropped 80 feet, but fortunately escaped with a broken nose and a badly cut head. The cause of the accident was the breaking either of the warping wire or of one of the main forward wing guys of steel tape.

A seventeen-year-old aviator, Walter Archer, attempted a flight on the afternoon of December 3rd at Salida, Cal., and came to a violent end. His machine, designed and constructed wholly by himself, is said to have been propelled by an electric motor, which was supplied with current from the wires of a light and power company. Apparently the machine was a helicopter, as it is reported to have risen vertically to a height of 700 feet before falling to the earth and being smashed.

The Aero Club of Cornell University intends to give a systematic course of instruction for the benefit of its members. The course will be conducted only with gliders, and is divided into three parts—theory, construction, and manipulation. It will be conducted entirely by the students themselves. A model glider contest is soon to be held in the armory. The models are limited to a certain size, and space for twelve is provided. Eight entries have now been made.

An aeroplane, carrying an Italian officer and a private, fell 80 feet at the military grounds at Centocelle on December 3rd. Both men were instantly killed. The machine was a Farman biplane, in charge of an engineer named Cammarota. The men met death in an attempt to make a short turn. Cammarota is the third Italian officer to be killed in an aeroplane accident in four months. Lieut. Vivaldi and Lieut. Saglietti both met death while making flights.

For the second time this year Los Angeles, Cal., will hold an international aviation meet from December 25th to January 3rd, 1911. The aviators entered are Hoxsey, Brookins, and Parmalee with their Wright biplanes; Willard, Curtiss, Mars, Ely, Shriver, and Capt. Baldwin with their Curtiss biplanes; Radley with his Blériot monoplane, and Latham with his Antoinette monoplane. There is a possibility that an attempt will be made to set up a new cross-country record for the SCIENTIFIC AMERICAN Trophy at this meet before the end of the year.

The Signal Corps of our army has at present but one lieutenant and nine enlisted men on duty in connection with aeronautics. In his report to the Secretary of War, Gen. Allen, Chief Signal Officer of the army, points out that until the Signal Corps is increased by suitable legislation, it will be impossible to furnish more officers and men for the absolutely necessary training demanded in airmanship. There is at present but one officer of the Signal Corps who is a licensed pilot for free balloons. At a low estimate, it is believed that at least twenty aeroplanes should be in the service of the United States on regular practice at different points of the country throughout the year, and present at the camps of instruction for regular troops and organized militia. This would provide but two aeroplanes for each camp of instruction, and it would require at least twenty specially trained officers as pilots. Moreover, each machine must carry at least one observer, who, experience has shown, will require much training and actual practice.

The first aviation show to be held in New York will open in the Grand Central Palace in connection with the Automobile Show from December 31st to January 7th next. A score of the latest aeroplanes of French and American manufacture will be on view. Among the most interesting of these will be found Moisant's two Blériot monoplanes—the passenger-carrying machine with which he flew from Paris to London, and the racer with which he won the Statue of Liberty prize flight—as well as his all-steel monoplane which he built in France a year ago; the Wright special altitude biplane with which Johnstone made his record of 9,714 feet at Belmont Park, and Santos Dumont's original "Demoiselle" monoplane. New monoplanes will be exhibited by the Scientific Aeroplane Company (which will show the first aeroplane equipped with a gyroscope), the Lovelace-Thompson Company, and the Walden-Dyott Company, while the Wrights, Burgess, and Glenn Curtiss will show their latest biplanes. The show will give an excellent opportunity to see the progress being made by Americans in aviation, and in the construction of improved heavier-than-air machines.

SCIENCE.

Considerable opposition has been raised to the admission of Mme. Curie to the Academy of Sciences. For the first time the question of the eligibility of a woman for any one of the five academies has formally been placed before the central committee.

The Poughkeepsie Common Council plans to disinfect the water used to sprinkle the streets by adding a chloride mixture which, it is thought, may check the spread of infectious diseases. A few preliminary experiments will be carried out to determine whether or not the scheme is really feasible.

Berthelot observed that alcohol absorbs nitrogen under the influence of silent electrical discharges or electrical "effluvia," and concluded that the absorbed nitrogen forms a complex amidin with the elements of the alcohol. Recent researches show that the absorption of nitrogen by alcohol is accompanied by the formation of ammonia, formic aldehyde, and formic and butyric acids. The ammonia, of course, combines with these acids, producing ammonium formate and butyrate.

The ash of animal organs usually contains a small quantity of silica, which has long been assumed to be derived from organic silicon compounds existing normally in the organism. Corny has recently discovered that the feathers of fowls and geese contain no organic silicon compounds, and that the minute quantities of silica which are often found in alcoholic and ethereal extracts of these feathers are of mineral origin. He obtained similar results with goose livers and the blood of birds of many species. It appears probable that the silica found in the ash of animal matter is always of mineral origin.

The physiological action of lactic acid is not yet thoroughly understood. Recent experiments by Faust show that lactic acid, added to the food of various carnivorous and herbivorous animals, does not exert any toxic action, unless the dose is very large, exceeding five per cent of the weight of the food. Even in this case the effect is merely that of excessive acidity. Owing to its antiseptic power, which is equal to three-fifths that of carbolic acid, lactic acid acts as a stomachic disinfectant and a regulator of the bowels. It might certainly be substituted with advantage for acetic, tartaric, and citric acids in food, and in the manufacture of confectionery and other alimentary products.

Certain experiments have led to the conclusion that radium emanation, ingested by the stomach or absorbed through the skin from baths impregnated with the emanation, is eliminated by the usual methods and especially through the kidneys. Kohlrausch and Plate, however, fail to detect, by the most delicate tests, a trace of radium emanation in the urine after ingestion by the stomach of matter containing 100,000 radioactive units, or after bathing in water of a radioactivity of 700,000 units. It would appear that the emanation can enter the system neither by the stomach nor by the skin, but only by the lungs, but additional experiments are required to decide the question.

Observations of changes in the field of view, the appearance of objects that were formerly below the horizon, and the disappearance of low-lying objects that were formerly visible, have been made in many parts of the world. Such changes occur with comparative frequency in the district around Jena, in Thuringia. Another remarkable alteration of level has been observed during the last half century in the foothills of the Jura. In 1861 only the tip of a church steeple at Altenkundstadt could be seen from the first story of the castle of Stroessendorf, on the opposite bank of the River Main. More and more of the steeple became visible each year, and now half of it can be seen from the first story of the castle. Another church steeple, situated a few miles northward, first peeped above the horizon of the castle about the year 1885 and has since been steadily rising.

The Franklin Institute of Philadelphia has awarded medals to Dr. Harvey John Wiley for work in the fields of agricultural and physiological chemistry; John Fritz, of Bethlehem, Pa., for work in the development of the iron and steel industries; John A. Brashear, of Pittsburg, for work in the production and perfection of instruments for astronomical research; Edward Weston, of Newark, N. J., for work in electrical discovery and in the advancement of electrical applicatio..; Ernest Rutherford, professor of physics, Owens College, Victoria University, Manchester, England, for his work in the advancement of the knowledge of electrical theory; Sir Joseph John Thomson, Cavendish professor of experimental physics, Cambridge University, England, for his work in the advancement of knowledge of the physical sciences; Sir Robert A. Hadfield, Sheffield, England, for his work in the advancement of knowledge of metallurgical science. Elliott Cresson medals have been awarded by the Franklin Institute at infrequent intervals during the last sixty or seventy years.

THE FIRST MARINE AEROPLANE

DESCRIPTION OF THE FABRE HYDRO-AEROPLANE

The Fabre hydro-aeroplane is an aeroplane provided with floats designed to enable it to navigate, rise from, and descend upon, water.

It is composed of a vertical chassis analogous to the frame of a bicycle, to which are fastened:

(1) At the rear the principal lifting surface (main plane) with the motor mounted at its after edge.

(2) In front, the horizontal and vertical rudders as well as the balancing planes.

(3) In the center the pilot's seat.

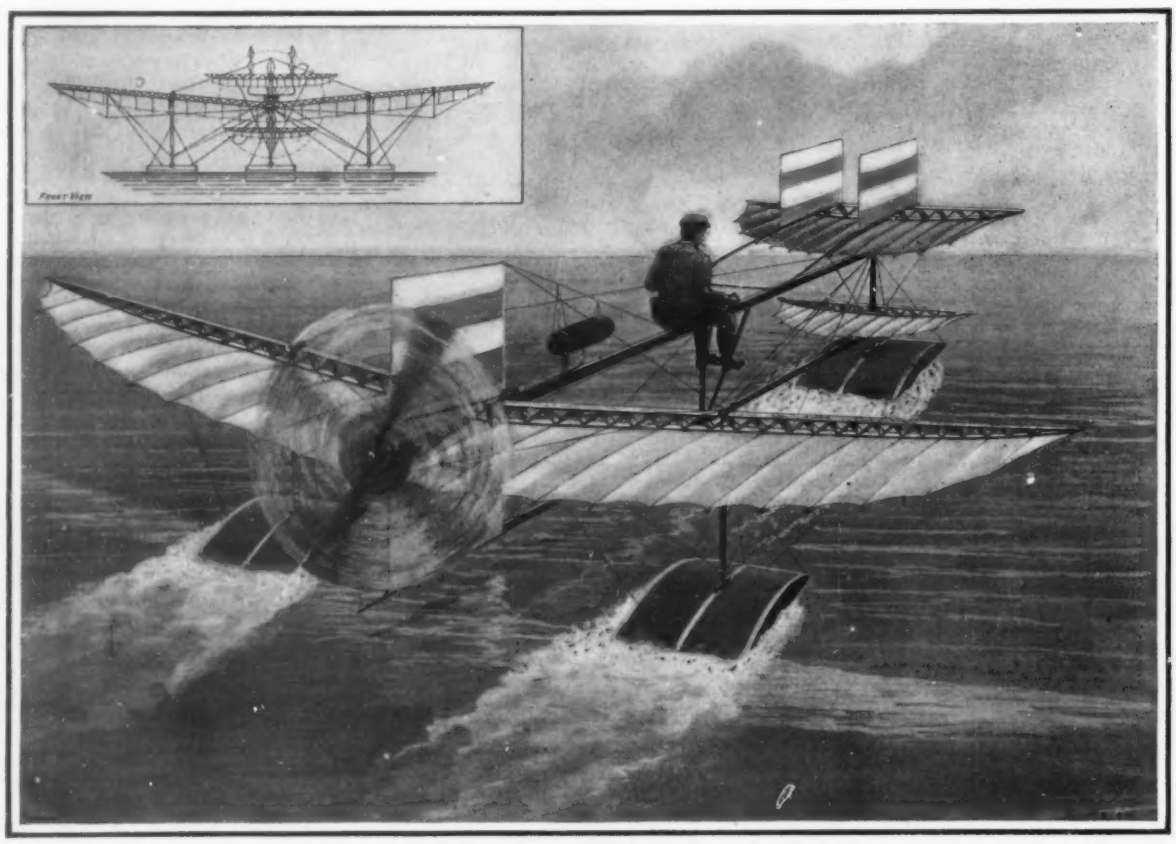
The assembled aeroplane rests upon three hydroplane floats, one in front of the chassis, and two others under the main plane half way between the center and two ends.

The floats upon which the aeroplane is mounted are hydroplanes of the "Ricochet-Bonnemaison" type, i. e., the bottom of each float forms a hydroplane surface. But, while in the "Ricochet" boats of Bonnemaison longitudinal stability is obtained by placing one surface in front of the other, and joining the two by a vertical surface forming a notch; in this case the front plane has been completely separated from the rear plane, and each forms the bottom of a different float. The following advantages are thus obtained: (*a*) The planes can be quite a distance from each other, which augments the longitudinal stability upon water. (*b*) As the rear plane is divided into two parallel floats located far apart, the lateral stability upon water is augmented considerably, and the rear floats are not placed in water already agitated by the passage of the first floats. (*c*) Each float, since it is made up of but a single continuous surface, has a form offering slight resistance to the air. It resembles the shape of the Antoinette monoplane wing. The resistance to the air that the notch would give is thus avoided, and the float performs a third function, since it acts as an auxiliary supporting surface in the air. (*d*) This form of float, with the plane surface below and the cylindrical surface on top, has the advantage of acting like a hydroplane plane even if the float be completely submerged. Thus, though it may be engulfed in a wave, it does not make great resistance, but, on the contrary, because of its speed, it receives an upward vertical impulse more energetic than ever.

The chief disadvantage of this type of hydroplane is the tremendous pounding it receives when moving rapidly over water that is only slightly rough. The portion of the lifting plane in contact with the water (which is a strip of only a few square inches along its rear edge when the plane is moving rapidly) is instantly increased tenfold at the least divergence of the water from a level surface, because of the slight inclination of the plane to the horizontal. The float then receives upward vertical accelerations equal to ten times its weight. To absorb these dangerous shocks the Fabre hydroplane floats have a flexible under surface. This is made up of thin veneered wood, which acts in the same way as the head of a drum. By this means even the framework of the float is protected from violent shocks from waves, just as the wheel and axle of a carriage are protected by the pneumatic tire from the jolts of a rough road. Moreover, very great flexibility is attained between the body of the float and the heavy parts of the apparatus. As may be seen by an examination of the photographs, the elasticity of nearly all the parts of the apparatus, wings, girders of the chassis, steel ropes, etc., comes into play to transmit the upward thrust of the waves to the motor and to the aviator. When the Fabre aeroplane is at rest upon water, the floats have an exceedingly slight draft. This amounts to only about 25 centimeters (9.8 inches) and decreases to nothing when in motion.

The tapering form of the bottom of the floats permits them to pass over weeds, ropes, and other floating bodies, or to skim over shoals without danger, even at high speed. No motor boat has so much ease of evolution in shallow water as such a hydroplane propelled by an air propeller. This is so strikingly true, that it even holds goods if there is *no* water. If the Fabre marine aeroplane should land on a meadow it would not be injured, for in such a case its hydroplane floats are sufficiently solid to act as regular skids. Moreover, a device is being perfected to permit it to start and land indifferently on land or water.

As for the resistance of the floats to salt water, it is enough to say that during a period of test one of these aeroplanes floated two months on sea water without being withdrawn.



THE FABRE MARINE AEROPLANE STARTING FROM THE WATER.

This monoplane is the first heavier-than-air machine to make successful flights starting from and alighting upon water. The insert shows the front elevation of the machine and its floats.

The wings of the Fabre aeroplane, which are capable of being folded, are stretched upon a special steel truss that can be seen in the illustration. This form of wing has been patented by M. Fabre. For a marine aeroplane the necessity of folding the wings when the aeroplane is at rest is more important than for a land machine. When the aeroplane arrives at a port where it is to stay several days, it is necessary to fold the cloth of the wings to prevent damage by sudden gusts. The Fabre wings accomplish the solution of this problem, and when the wings are folded, the machine resembles a boat under bare poles.

The wing is composed of four parts: 1. A reinforced or trussed longitudinal girder placed at the front edge of the wing, in the position which the bones occupy in the wing of a bird. This is the only longitudinal girder of the wing. It is of very substantial construction, as the uprights from the floats attach to it, and it is depended upon for giving rigidity to the whole structure. This zigzag form of girder, which is of a new and patented construction, is used not only for the wings and rudders, but also for the members of the chassis, and for the framework of the floats; in a word, the whole apparatus is essentially a Fabre reinforced beam.

2. The ribs, which correspond to the quill-feathers of a bird's wing, consist of thin strips of wood superposed and glued together. They fit into sockets on the bottom of the single longitudinal of the wing. It will thus be seen that the Fabre wing is entirely mechanical in construction, very easily demountable and remountable, yet at the same time it is fashioned in close resemblance to the wing of a bird.

3. The covering of the wing consists of a cloth known as "simili-silk," such as is used for the light sails of racing yachts. Sewed by hand, provided with eyelets, and reinforcements such as are fitted to sails, the cloth is not tacked on, but is laced in place. It may therefore be rapidly removed for washing or mending, and quickly replaced without dismounting any part of the skeleton of the wing. After the ribs are put in place, the cloth is slipped on them (it being provided with pockets to allow of this), and laced to the main longitudinal girder. An ingenious arrangement of wooden eyelets sewed in the hem of the cloth allows of this, while at the rear the cloth is fastened to each end of the rib by means of patented spring clamps.

In addition, such an arrangement secures the advantage of detaching the cloth when the aeroplane is not in use, and of attaching it again at will. It is thus superior to many aeroplanes, whose cloth is greatly marred by wrinkles and creases after a few weeks' use.

4. Suitable braces hold the main beams of the wings from turning in their sockets when the wings are supporting the machine in flight. Steel cables fastened to the lower ends of these braces serve to regulate the angle of incidence of the wings, or to warp them. The wings are also trussed with similar braces and are mounted upon the floats by means of uprights of the same kind.

The Fabre hydro-aeroplane made its first flight at Martigues, France, on March 28th, 1910. It attained a speed of 55 kilometers (34.2 miles) per hour in the water. At first it rose about 2 meters (6.56 feet) from the surface and flew for 500 meters (1,640 feet). Then it made a flight at 3 meters (9.84 feet) height and somewhat longer.

On May 17th a series of flights were made before Louis Paulhan. On this day, after rising easily and gracefully from the water, the machine attained a height of at least 20 meters (65.6 feet) and made a splendid 6-kilometer (3.73 mile) flight.

In coming down, however, it "volplaned" at too great an angle and landed with a splash. Under like conditions on land such a descent would have meant total wreck for the machine. As it was, Henri Fabre, who always pilots the machine, was thrown head first into the water, receiving no injuries, and the aeroplane suffered the breakage of one end of a wing and of one of the hydroplane floats—almost nothing at all.

The Fabre aeroplane has a depth of about 6 feet and an area of nearly 280 square feet. A 50-horse-power, 7-cylinder Gnome engine drives an 8½-foot two-bladed Chauviere propeller at 1,100 revolutions per minute.

The total weight in flight is 950 pounds, giving a loading of 3.4 pounds per square foot. The design of the aerodynamic part of the machine is accredited to M. Marius Burdin.

PHOTOGRAPHING LIVING INSECTS

BY HAROLD BASTIN

During recent years, as my readers are doubtless aware, a remarkable change has taken place in regard to natural history as a study. In the old days it was customary to form a collection of mummified specimens—plants, shells, and so on. Moreover, the student cared little or nothing about the living plant or the living animal so long as its dried remains, duly labeled, had a place in his herbarium or cabinet. But to-day, all this is changed, thanks to what we call the "nature study movement." We realize that a store of knowledge respecting the habits of living things is infinitely more valuable than the finest collection that was ever made.

Thus, many of those who are enamored of entomology (or the study of insects) have renounced the use of the old-time butterfly net. They find pleasure in observing the living insect, and recording in a notebook exactly what they have seen. To such I would say: Why not begin to catch insects with a camera? The pursuit is a fascinating one. Moreover, the resulting pictures serve to illustrate and to emphasize one's notes in a manner that mere sketches, no matter how carefully drawn, cannot possibly equal. With a camera, one is able to picture phases of the insect's existence so evanescent that it is hopeless to attempt to obtain accurate sketches of them; while a photograph is naturally far more true to life—far more replete with detail—than the best work of an artist. I do not mean, of course, that the camera can rival the artist in his own sphere. But for purposes of science—for portraying the characteristic pose of an insect, or one of the transitory phases of its life—a photograph is far better than a drawing.

It is not my purpose in this article to instruct my readers in the technique of photography. I shall assume that they are familiar with the methods of using a camera, and the mysteries of the dark room with its array of bottles. In any case, these matters can be studied in books, or under the tuition of a friend. But I desire to supply a few hints respecting the best methods of catching insects with the camera, and to offer a few suggestions which will, I think, be of use to the beginner in this delightful pastime. Theoretically, the correct way to catch insects with the camera is to sally forth to the lanes and meadows, and "snap" the beauteous creatures as they poise for a moment upon a flower or hang from a leaf or grass-blade. Unquestionably, many good pictures may be obtained in this way, especially if one take advantage of times and seasons. For instance, most butterflies are late risers, while they retire to rest long before the setting of the sun. Thus, by being up betimes, one may often get good pictures of these insects ere they leave the leaf or flower on which they have passed the night. I have in mind an exquisite photograph of two dew-bespangled white butterflies upon a flower, taken by a well-known photo-artist. He wished to photograph these insects late in the evening, but, owing to the lack of light, gave up the idea and rose early the next morning. As a result, he obtained one of the most striking butterfly portraits ever taken.

In photographing an insect, the reader will generally find it advisable to be provided with a background. In this way, the mass of tangled vegetation which so often confuses the "point" of a nature photograph may be shut out. The background may conveniently take the form of a banner, the pole having a spiked end for driving into the ground. This contrivance can be rolled up when not in use, and easily carried. A specially prepared canvas is sold for this purpose by dealers in photographic apparatus; and it has the advantage of being differently colored on either side—thus giving the photographer a choice of backgrounds without adding to the weight of his paraphernalia. The material is quite inexpensive.

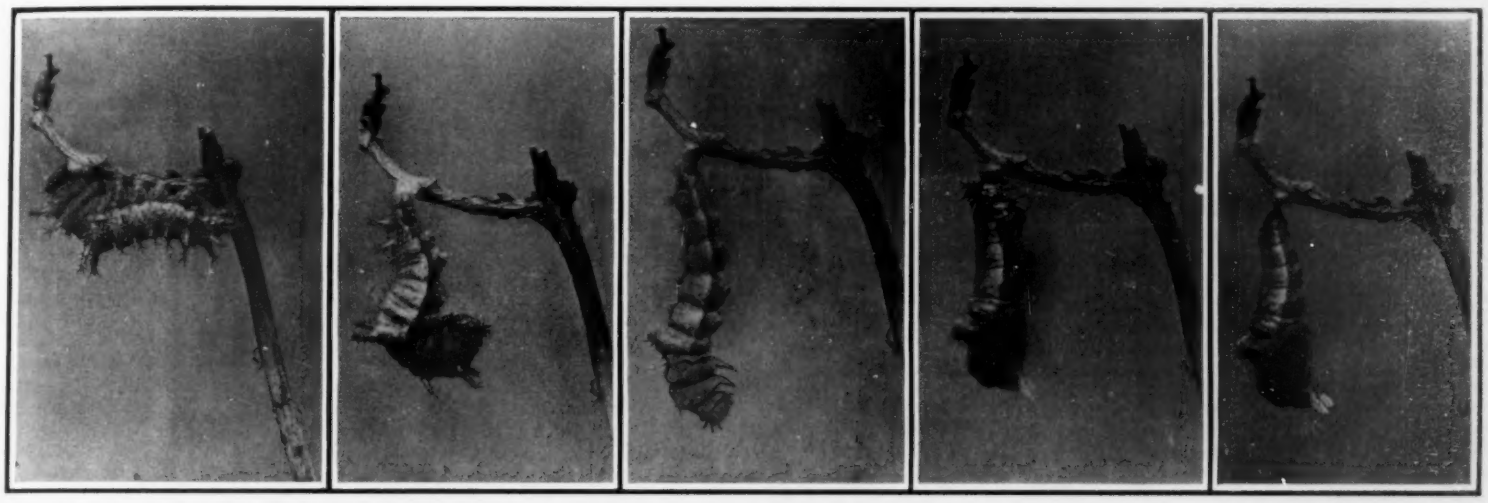
For the outdoor photography of insects a windless day is essential. But this being granted, the beginner should have little difficulty in obtaining pictures of resting butterflies. Not yet fully awake to the glories of the early summer morning, the insects will readily allow the cautious operator to approach, focus, and obtain the desired exposure. Later in the year, the flower heads of certain umbelliferous plants are often crowded by "soldier and sailor" beetles, and good pictures of them are usually obtainable. Other good subjects for use in outdoor photography are the examples of protective resemblance, such as moths upon trees.

In the case of certain pictures illustrating this article the reader will notice that a black background has been employed. This is a piece of black velvet. Often, when it is possible to give a long enough exposure, a dark or black background will be found most useful, as it emphasizes the detail in the finished picture. One must bear in mind, however, that a black background calls for a relatively longer exposure, even in a good light, than is necessary when a pale one is used. For this reason dark backgrounds are more applicable to indoor work, where one has one's subject more under control.

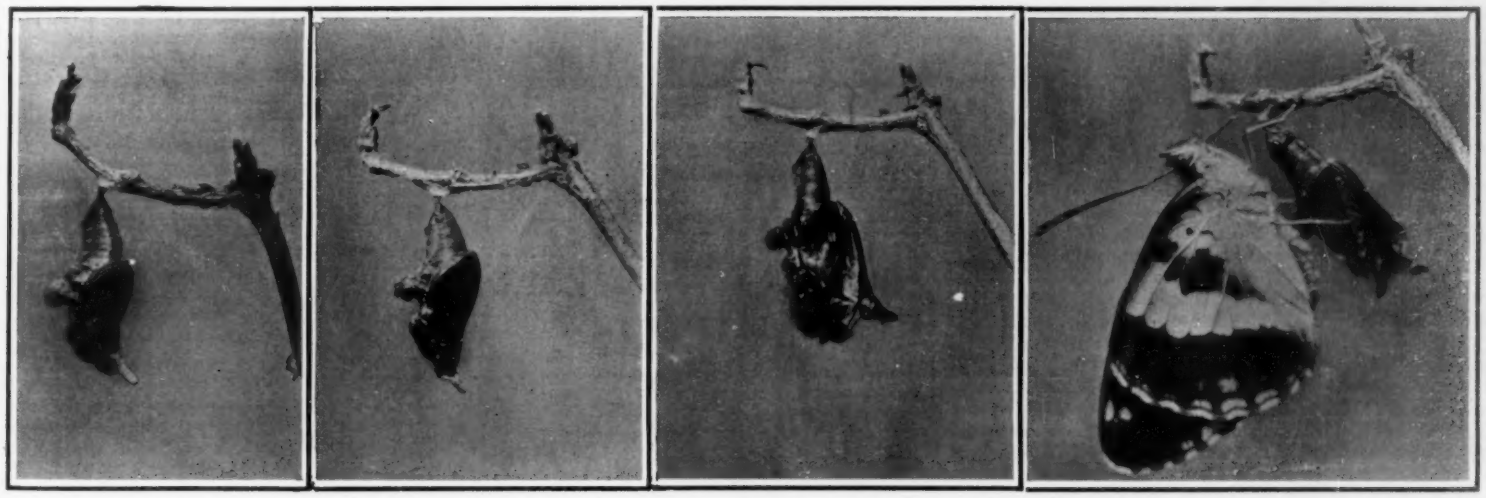
Here I would say that while the outdoor portraiture of insects is entirely feasible, and should be practised wherever possible, more satisfactory results are obtained by bringing one's sitters into the studio. This word "studio" has a grand sound I know; but the reader need not be alarmed. A greenhouse or conservatory will serve the purpose well enough. But I am inclined to think that an ordinary room on the ground floor, possessing a good north window, is even better. Photographs of insects which have been taken in a glass house, with strong light coming from all directions, are apt to be somewhat flat and devoid of "form values." Whereas, when the subject is lighted strongly on one side, its bulk is emphasized—it seems to "stand out" from the picture in a life-like manner. At the same time, the worker must be careful to balance his light effects, else the shadows will be too heavy. It is wise to fix in one's mind the fact that a shadow cast by the object itself looks far less formidable than it will appear in the photo-print when this is made. A little practical experience will enable the worker to control and balance the light by means of reflectors—a piece of looking-glass or a sheet or two of white cardboard—arranged to cast back the light upon such portions of the subject as appear to be in too heavy shadow. In this way, the light effects are rounded, not flat, and the true form of the plant or insect is more distinctly shown.

Many specimens bearing upon the life histories of

(*Continued on page 487.*)



The caterpillar spinning the silk attachment pad. The caterpillar hanging from its silk attachment pad. The caterpillar stretching (and undergoing at intervals strong muscular contortions) in order to free itself from its skin. The skin of the caterpillar worked off, revealing the chrysalis. The caterpillar skin has been finally discarded.



The chrysalis assuming its normal shape. Perfect chrysalis normal in shape with hardened skin. The butterfly breaking through the chrysalis skin. The perfect butterfly newly emerged.

PHOTOGRAPHING LIVING INSECTS.

A GREAT RAPID TRANSIT SYSTEM FOR A GREAT CITY

DOUBLING THE CAPACITY OF NEW YORK'S SUBWAYS AND ELEVATED ROADS

Out of the maze of plans and proposals for the extension of New York city's system of subways, which has been under discussion during the past few years, there has at length been evolved what seems to us to be a thoroughly adequate system, free from many, if not all, of the objections which have been urged against previous plans.

The one exception is that the whole system, as completed, will be operated by a single private corporation, and the element of competition will be entirely lacking. This, however, is not so serious a drawback as might appear at the first consideration; for if the proposed extensions, as submitted to the Public Service Commission by the Interborough Rapid Transit Company, be made, the relations established between the city and the company will be such as to render it expedient for the operating company to give the city at all times the very best service of which their lines are capable.

The so-called Tri-Borough route, as laid out by the Public Service Commission, possessed at once an advantage and a disadvantage; both of great importance. It was to have been an entirely independent system, and, therefore, would have introduced in the rapid transit situation the greatly needed spur of competition. On the other hand, it would have necessitated the payment of two five-cent fares on the part of a large percentage of the traveling public; a condition which, in the case of many of the poorer people, would have amounted to a positive hardship.

A glance at the accompanying map shows that the existing lines of the Interborough Company, which, in justice to the Rapid Transit Commission, it should be said, represent only part of the complete scheme as originally laid out, leave two important sections of New York city, the upper east side and the lower west side, respectively, above and below Forty-second Street, without any easily accessible rapid transit service. The Tri-Borough route of the Public Service Commission provided greatly needed extensions in the Bronx and Brooklyn, and by means of its Lexington Avenue line, gave to the eastern side of the city a four-track express and local service; but it had the drawback that no provision was made, either for connection with the Pennsylvania terminal station, or for an extension of the line down Broadway or Seventh Avenue for the service of the lower west side of the city.

The present proposal of the Interborough Company not only includes practically all of the lines contemplated in the Tri-Borough plan, but it also makes provision for the lower west side below Forty-second Street, with a tunnel connecting the lower end of that line with the rapid transit system in Brooklyn.

The proposed extensions by the Interborough Company of its present subway line are as follows:

Extensions Down the Lower West Side of New York and to Brooklyn: From Times Square under Seventh Avenue, Varick Street, West Broadway, and Greenwich Street to Liberty Street as a four-track road, and from Liberty Street to the Battery as a two-track road, with a branch from the intersection of Greenwich Street and Liberty Street, under Liberty Street and East River to Pineapple Street in Brooklyn, and under Pineapple and Fulton Streets to a connection with the Brooklyn extension of the existing subway, as a two-track road; with a further extension from the terminus of the Brooklyn extension of the existing subway at Atlantic Avenue, under Flatbush Avenue and Eastern Parkway to Utica Avenue as a four-track road, and from Utica Avenue to Buffalo Avenue under Eastern Parkway as a two-track road; also a two-track extension from the existing Subway at Lafayette and Flatbush Avenues, Brooklyn, under Lafayette Avenue to Broadway.

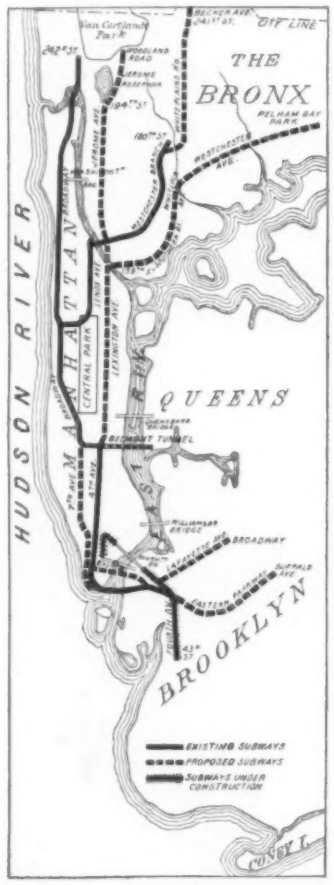
Extensions Up the Lower East Side and to the Bronx: From about Thirty-fifth Street and Park Avenue, under Park Avenue and private property at or about Forty-second Street to Lexington Avenue and the Harlem River to a point south of 149th Street as a four-track road, thence dividing, with two tracks, to a connection, east of Mott Avenue Station, with the West Farms branch of the existing Subway; thence two tracks under Mott Avenue, 153rd Street, and River Avenue, to 157th Street, and from 157th Street over River Avenue to about 162nd Street as an elevated structure. At 162nd Street and River Avenue a connection will be made with the Jerome Avenue extension of the Ninth Avenue elevated line of the Manhattan Elevated Railroad.

A two-track subway extension, diverging from the proposed Lexington Avenue extension at about 138th Street, and running thence under private property, 138th Street, Southern Boulevard, and Whitlock Avenue, to a point in private property south of Westchester Avenue; thence as a three-track elevated railroad over Whitlock Avenue and Westchester Avenue to Pelham Bay Park.

A two-track elevated extension from the West Farms division of the present Subway at about 179th Street, over private property to a point between Bronx Park and the property of the New York, Westchester and Boston Railway Company; thence north over private property and public streets to Bear Swamp Road and White Plains Road; thence over White Plains Road to a connection with the proposed extension of the Third Avenue line of the Manhattan Elevated Railroad at a point north of the intersection of White Plains Road and Gun Hill Road.

The Cost of Construction: It is estimated that to construct and equip the lines as thus laid out will call for the expenditure of $128,000,000. The Interborough Company offers to build and equip the same for the sum of $53,000,000, which is to be furnished by the city. The city also would provide the necessary easements and right of way. The company will supply the funds necessary to defray the additional cost of construction and equipment, which would amount to $75,000,000.

It should be noted here that the city has agreed



PLAN OF PROPOSED SUBWAY EXTENSIONS WHICH WILL DOUBLE THE PRESENT CAPACITY.

to take over the Belmont tunnel, which has been built under the East River from Long Island City to Forty-second Street, and under Forty-second Street as far as the Grand Central Station. The whole of the four-borough routes as thus built and proposed, the Interborough Company agrees to operate upon a five-cent basis.

The $30,000,000 Extensions of the Elevated Roads: Second only in importance to the subway extensions is the vast system of additional new elevated structures, and laying of third rails on existing tracks, which the Interborough Company will undertake when the pending arrangements with the city officials have been completed. The company is to complete the third-tracking of the Second, Third, and Ninth Avenue elevated lines, these additional tracks providing for an express service along these important routes. Also the Ninth Avenue line is to be extended across the Harlem River and up Jerome Avenue to Woodlawn Avenue. The Third Avenue elevated line is to be extended from its present terminus along White Plains Road to 241st Street. A spur is to be built to connect the Second Avenue line with the Queensboro Bridge, over which trains will be operated. Lastly, a new four-track road will be constructed, over which the Second and Third Avenue trains can be operated direct to the City Hall Station at the Brooklyn Bridge entrance.

Discussing recently these proposals as submitted to the Public Service Commission, the president of the Interborough Company pointed out that the Interborough plan would more than double the mileage of the present Subway, and taken in connection with the elevated improvements, would more than double the carrying capacity of all the Interborough Rapid Transit Company's lines. He pointed out that one great advantage of this offer is that the new subways can more quickly be put into operation; since, as construction progresses, each newly built part can be joined to the existing lines, thereby making it immediately available, and obviating the necessity, as would be the case if a separate system were built, of waiting until the entire work was completed.

Our front-page engraving shows a typical section through the Lexington Avenue subway, the point chosen for the illustration being at Eightieth Street. Because of the limited width of this thoroughfare, it will be necessary to build the four-track road as a double-deck structure, with the local trains accommodated on the upper level and the express trains below. The plans of the Public Service Commission, upon which our drawings are based, call for a larger tunnel clearance than that of the existing Interborough subway, the clear width being 14 feet and the clear height 15½ feet above the top of the rails. These dimensions would admit a train of standard Pullman cars. If the Interborough plan be adopted, the new tunnels will be made to conform to the old, which have a clear width of 12 feet and a clear height of 12½ feet above the top of the rail. In the new tunnels, however, the clearance will be raised to 13 feet, to admit of using a greater depth of rock ballast below the ties.

The general system of construction will be reinforced concrete of the same general character as that shown in our engraving as inclosing the upper deck structure. Steel columns and girders, inclosed in concrete, will be used on the lower deck, wherever changes of level and other conditions render it desirable. An important improvement affecting both the safety and ventilation of the tunnel, and especially the latter, is the provision of a continuous solid wall between adjoining tracks. This will cause the trains to act with a piston-like effect, driving the tunnel air in front of them, and drawing in fresh air at the stations and other suitable openings.

Time of Completion: The existing subways comprise about 25½ miles of track, and the proposed extensions will add about the same amount. The third-tracking and extensions in the Bronx and to connect with the Queensboro Bridge of the elevated road will about double the trackage of the existing elevated roads. The Interborough Company agrees to complete the elevated extensions and additions in two years' time, and they are prepared to complete the new subways in five years from the date of signing the contract. That this estimate is not too optimistic, is shown by the fact that the present subway from Brooklyn Bridge to Harlem and the Bronx was completed in from four and a half to five years' time.

Baseball Mathematics.

Baseballs have been caught when dropped from the top of the Washington Monument, by at least two well-known league players. The distance dropped is 542 feet, and by the time the ball reached the catcher's hands its velocity was calculated to have been about 180 feet per second, or over 120 miles an hour. Suppose that the pitcher were to throw a 9-ounce ball to the top of the Washington Monument. How much energy would he require for that purpose? The American Machinist answers that question in a recent issue. According to that journal, if the pitcher could throw such a ball with such strength that it would reach the top of the monument, assuming that his hand is propelling the ball through a distance of 5 feet before letting go, he would have to exert a constant pressure of about 60 pounds upon the ball until it left his hand. If the catcher, in receiving the dropped ball, allowed his hands to move down a distance of 2 feet, the average stopping force which he exerted must have been nearly 150 pounds. The probabilities are that his hands stung somewhat after the performance.

Samuel F. Perkins dropped 125 feet on November 30th at Kansas City, while being supported in the air by a string of kites. He had risen 150 feet, despite unfavorable weather conditions, when the upper kites collapsed in a 60-mile wind. The parachute effect of the smaller kite checked his descent, so that he was not badly injured.

Correspondence.

THE ALLOY "STELLITE,"

To the Editor of the SCIENTIFIC AMERICAN:

In your issue of the SCIENTIFIC AMERICAN for November 19th, 1910, in which you publish an abstract of the account of the alloy "Stellite," I note that a false impression would be created by paragraph three, a part of which reads as follows: "After some experimenting, I was able to produce metal that would forge out perfectly into thin strips, which showed no tendency to check." The above statement refers to the *cobalt*-chromium alloy, while the paragraphs preceding it relate entirely to the nickel-chromium alloy.

I would therefore refer your readers to the full text of the article, published in the SCIENTIFIC AMERICAN SUPPLEMENT of the same date.

Kokomo, Ind. ELWOOD HAYNES.

DISTINCTION TO BE MADE BETWEEN INHERENT AND AUTOMATIC STABILITY OF AEROPLANES.

To the Editor of the SCIENTIFIC AMERICAN:

The Literary Digest of November 5th, 1910, contains an article printed from Engineering (London, October 7th), "Stable Aeroplanes Not Desired."

In this article it reads: "The term automatic stability may be used in two senses. In the first place, it may simply mean such a disposition of the planes that the machine has a tendency to fly in a horizontal position in still air; in the second, it may mean some device which will keep the machine horizontal in a wind and correct any deviation caused by puffs and eddies."

This definition of automatic stability needs a correction. There is only one true sense to the term automatic stability; the term cannot be used in two senses.

What is generally called automatic stability is only a certain inherent stability, which is brought about by the outer shape of the aeroplane, while the real automatic stability is brought about by a device which exerts power.

A gyroscope in connection with a device for warping the main planes or working balancing planes (wingtips or ailerons, or the like) will be found to be impracticable. It will be done by means of explosions coming out of the supporting surfaces of the aeroplane, when the aeroplane dips.

Automatic valves, weighted valves working by gravity, will answer the purpose of reducing or entirely cutting off these explosions, as explained in the patents referred to in SCIENTIFIC AMERICAN SUPPLEMENT No. 1682, March 28th, 1908, page 207, in article, "A New Aeroplane." I also refer to SCIENTIFIC AMERICAN SUPPLEMENT No. 1820, November 19th, 1910, page 332, the article, "Practice and Theory of Aviation—V."

What is termed automatic stability in that article is nothing but inherent stability. Neither the Voisin machine nor any of the other now existing aeroplanes has the automatic stability in the true sense of the term.

It may be added that none of the present aeroplanes is of the type which will be the type of the future.

In that manner the aeroplane itself exerts a power at each and every critical moment. With the inherent stability alone the aeroplane will be "caught napping" when unfavorable circumstances happen to come together. This inherent stability does not deserve the name automatic stability; the expression is wrong.

Besides spending so much money for prize flights (killing the aviators), a fund ought to be created to help inventors to develop aeroplanes which have the prospect of success. S. THEOD. GIBON.

Clarksville, Tenn.

"AN OLD BALLOON FOUND IN CANADA."

To the Editor of the SCIENTIFIC AMERICAN:

Your article of November 26th, under the above heading, signed O. H. Ingram, Eau Claire, Wis., interested me. In *resumé*, he was a lumbering superintendent, operating far north of Ottawa in 1854 or 1855, and described how some of the loggers had found two used-up balloonists, the chief of whom was Le Fontaine. After their recuperation the balloonists and some of the men hunted up the balloon and divided it among all hands. Mr. Ingram afterward being presented some of its pieces and ropes. He asks you for information regarding the records of this flight, which he thinks started from St. Louis.

The undersigned believing that he can direct Mr. Ingram to an authentic history of this flight—indeed, an account written by one of its participants.

On October 26th, just the day before the safety of A. R. Hawley and Augustus Port was announced, after their most sensational flight from St. Louis, ending 180 miles north of Quebec, I had a half column in the Indianapolis Star descriptive of the flight from Buffalo of Prof. La Mountain and my cousin, Mr. Haddock, not long before the civil war, reciting their dreadful experiences and describing their rescue by a trapper and hunter in the wilds of Canada, explaining that the story had made a great impression on me in my boyhood days, as Haddock was my cousin, whom I then regarded as the bravest man in all the world, my story being described as one of purely family history only, and (as does Mr. Ingram's) ending by asking for "further information from any old-time balloonatic."

To my surprise, there soon appeared in this same newspaper, the Indianapolis Star of October 31st, a card from Melvin Chapman, Pendleton, Ind., supplementing my story, showing that this flight may be found described in a book, "The Picturesque St. Lawrence River," of which John A. Haddock, Watertown, N. Y., is the author—one of the men who made the flight. Mr. Haddock died at Watertown, his lifetime home, in 1899.

Mr. Chapman's card appends the following paragraph condensed from the above-mentioned book, which shows that both Mr. Ingram and myself were in error—he in the year of the flight, the name of the pilot, and the starting point, and I in its starting point (while Mr. Ingram's story corrects mine as regards the personnel of the rescuing party), viz:

"The balloon 'Atlantic,' Prof. La Mountain pilot, and John A. Haddock assistant, sailed from Watertown, N. Y., at 5:33 P. M. September 22nd, 1859. They landed in the night in a dense forest 180 miles due north of Ottawa, Canada. They arrived at Ottawa October 4th, twelve days after the ascension. From there they sent a message to their friends informing them of their safety."

The Hawley-Post 1910 flight and rescue was in many respects an exact reproduction of the La Mountain-Haddock 1859 flight and rescue.

Please ask Mr. Ingram to revise his dates and see if he cannot place his experience in 1859. It must have been in that year, unless, indeed, Prof. La Mountain was rescued twice in the same region, and there four or five years apart.

I have recently received a rather remarkable verification of this 1859 date through my son, Clarence B. Clarke. He is an enthusiastic post-card collector, having many thousand cards from all over the world, with a particular penchant for balloons, aeroplanes, etc., who is an especial admirer and buyer of the SCIENTIFIC AMERICAN because of its "fly" features, and who, in fact, called my attention to your Ingram article. One of his cards is from Miss Orra D. Gould, Lima Centers, Wis., who, after displaying familiarity with the Star's stories above mentioned, writes that her mother, when a girl, saw this La Mountain ascension at Watertown in 1859. W. B. CLARKE, M.D.

Indianapolis, Ind.

Revocation of the Attorney's Appearance Rule.

It will be remembered that on September 15th last, the Secretary of the Interior made a rule that firms of attorneys or agents would not be permitted to practice before the department or its bureaus in any proceeding involving the services of an attorney or agent, unless they were represented by one or more duly qualified members of the firm in person. This new rule, we understand, was the result of some irregular practices in the Land Office. Since the Patent Office constitutes one of the Departments of the Interior, it naturally came within the provisions of the rule. As a result, patent attorneys were constrained to spend much valuable time in signing notices of appearance, instead of really attending to the interests of their clients. The Secretary of the Interior has now revoked the rule so far as the Patent Office is concerned, and attorneys are henceforth permitted to appear in the old way.

Cement Concrete Vats and Tanks.

BY ALBERT MOYER, ASSOC.AM.SOC.C.E.

Impervious, odorless, tasteless, and sanitary vats and tanks for buttermilk, wine, oil, pickles, sauerkraut, etc., can be constructed of reinforced concrete, the reinforcing to be designed by a competent engineer, provided the interior surfaces are treated as follows:

After the forms are removed, grind off with a carborundum stone any projections due to the concrete seeping through the joints between the boards. Keep the surface damp for two weeks from the placing of the concrete. Wash the surface thoroughly and allow to dry. Mix up a solution of 1 part water-glass (sodium silicate) 40 deg. Baumé, with 4 to 6 parts water, total 5 to 7 parts, according to the density of the concrete surface treated. The denser the surface, the weaker should be the solution.

Apply the water-glass solution with a brush. After four hours and within twenty-four hours, wash off the surface with clear water. Again allow the surface to dry. When dry apply another coat of the water-glass solution. After four hours and within twenty-four hours, again wash off the surface with clear water and allow to dry. Repeat this process for three or four coats, which should be sufficient to close up all the pores.

The water-glass (sodium silicate) which has penetrated the pores has come in contact with the alkalies in the cement and concrete and formed into an insoluble hard material, causing the surface to become very hard to a depth of ⅛ to ¼ inch, according to the density of the concrete. The excess sodium silicate which has remained on the surface, not having come in contact with the alkalies, is soluble, therefore easily washed off with water. The reason for washing off the surface between each coat, and allowing the surface to dry, is to obtain a more thorough penetration of the sodium silicate.

It is obvious that concrete surfaces so treated, if hard, impervious, and insoluble, have been made impervious, tasteless, odorless, and sanitary.

The Current Supplement.

The SCIENTIFIC AMERICAN SUPPLEMENT No. 1824 contains, among other interesting articles, an account of the disposal of the Alexander Prize for Aeronautic Motors. This was a prize of $5,000 offered for a motor suitable for aeronautical purposes. The article describes tests which were conducted on six engines at the National Physical Laboratory. Prior to October, 1907, the telegraph was used almost universally for dispatching trains on the more important trunk-line railways of the United States. The value of the telephone for this purpose is now generally recognized. The subject is admirably discussed in a paper by G. K. Heyer.—The Berlin correspondent of the SCIENTIFIC AMERICAN describes a horseshoe-rolling machine of German manufacture.—Dr. Charles P. Steinmetz, the distinguished electrical engineer and physicist, writes instructively on the physiological effects of light, discussing particularly the more harmful effects and how they may be avoided.—Katherine Louise Smith in an article called "The Great River of the Northwest" gives a picturesque account of a great stream that is destined to play a conspicuous part in the development of the Northwest.—The most obvious method of seeking the North Pole is to sail due north from Norway, for the Pole is only 700 miles farther north. The way, however, is blocked by ice pack, through which it is practically impossible to force a passage. In 1909, when the dirigible airship had been so far perfected that it accomplished very long journeys, the idea of employing the new vessel in scientific polar exploration was advanced by Count Zeppelin. Dr. Bruno Sergert contributes an excellent article on this Zeppelin plan and its chances of success.

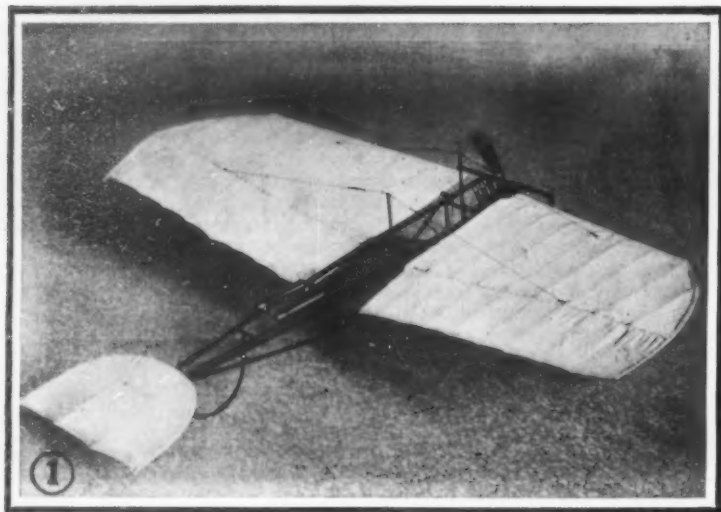
The Scientific American Cyclopedia of Formulas.

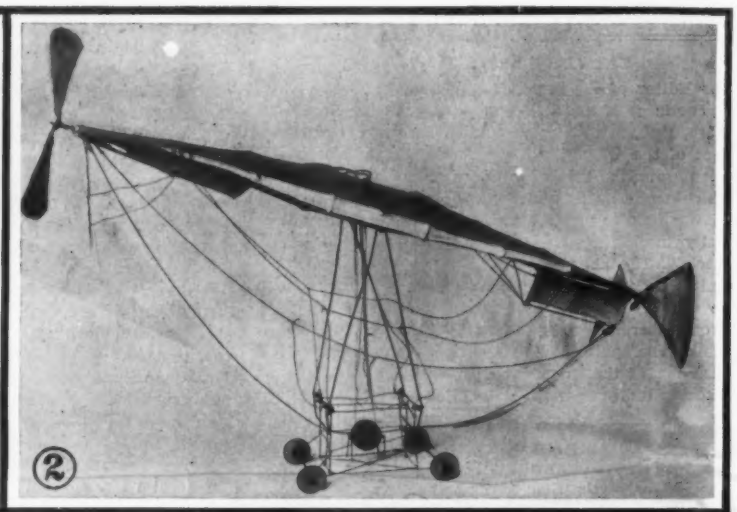
It is with great pleasure that the publishers of this paper announce the completion of "The Scientific American Cyclopedia of Formulas," on which Mr. Albert A. Hopkins, the Query Editor of the SCIENTIFIC AMERICAN has been engaged for the last two years. This work is partly based on the twenty-eighth edition of "The Scientific American Cyclopedia of Receipts, Notes and Queries," which is possessed by a considerable number of our readers. The new work will prove an admirable complement to the older volume, as a considerable number of the formulas are new and not contained in the former book. Over 15,000 of the most useful formulas and processes have been selected from a collection of nearly 150,000. The formulas are classified and arranged in chapters, and an index made by professional librarians renders it easy to find any formulas desired. A complete prospectus giving a detailed account of the various chapters will be mailed on application. The 1,065-page book, is beautifully printed and bound and is well illustrated. It is further described in our advertising pages.

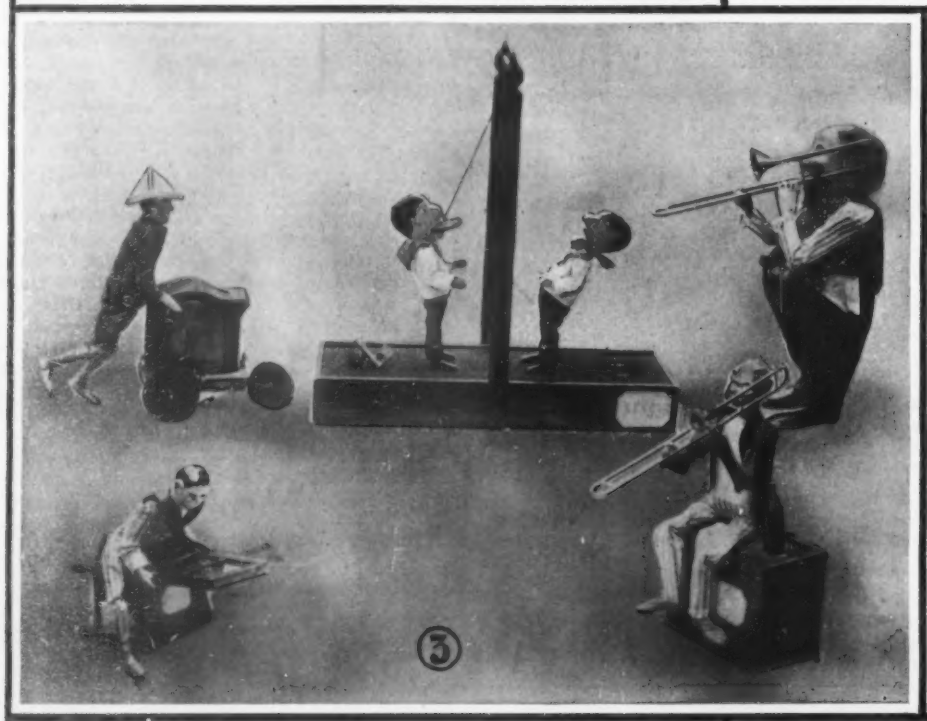
Daniel Arthur.

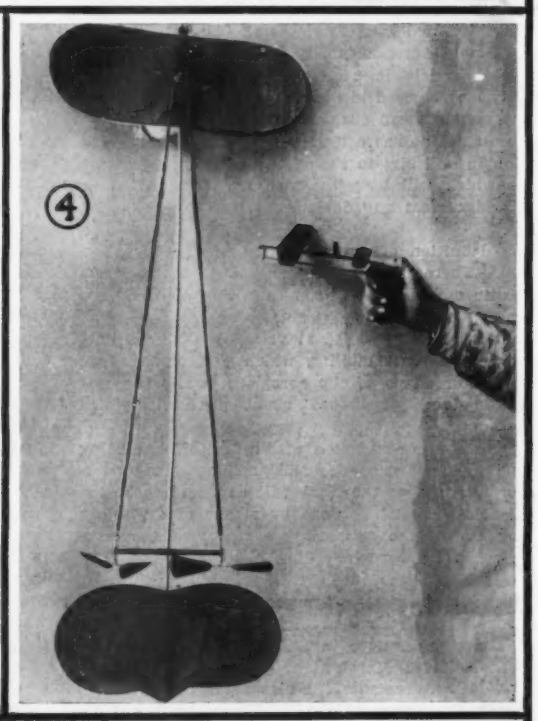
Mr. Daniel Arthur, a well-known inventor and contributor to popular scientific journals, was accidentally killed under a New Jersey Central railroad train on November 29th last. Mr. Arthur was vice-president and treasurer of the Arthur Company Machine Works of New York city. Although a Scotchman by birth, he had lived in this country from his sixth year. He was a very successful inventor of mechanical appliances. His scientific articles, all of them characterized by lucidity of expression and thoroughness of treatment, have appeared in the SCIENTIFIC AMERICAN, the Horological Review, the Jewelers' Weekly, and other publications. His latest paper was on "The Calendar Concept and Its Evolution," which has since been published in book form. Besides his interest in invention and sciences, Mr. Arthur took a great historical interest in the city of Brooklyn, of which he was a resident. He combined to a rare degree the qualities of a scientist and a literary man.

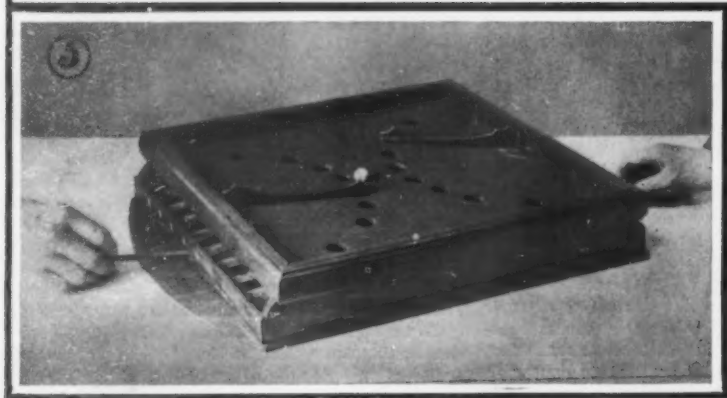
A phonograph may be employed to receive and record and also to transmit telephone messages. In the Berlin telephone exchanges telephones are being installed for the purpose of making the familiar and often repeated responses: "Busy," "Out of order," etc.

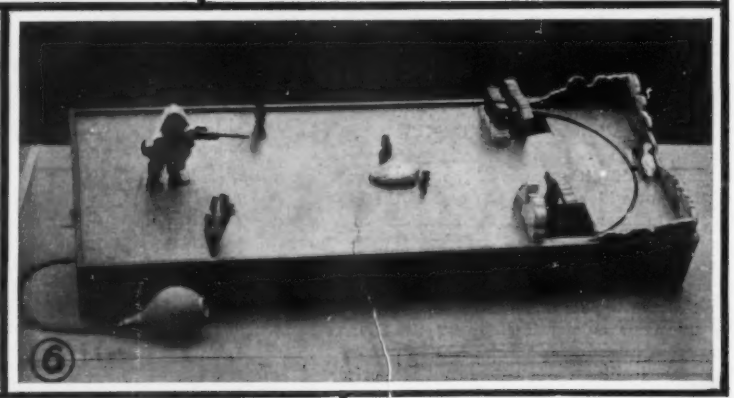


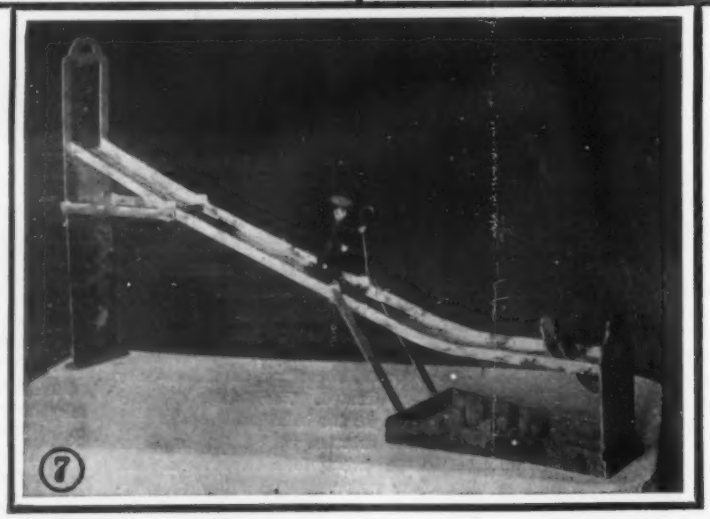












1. Martin aeroplane. 2. Hébert aeroplane-parachute. 3. Boucheron's mechanical toys. 4. Rouilot aeroplane. 5. Georges billiard table. 6. Boucheron's huntsman. 7. Oberlander's ski runner.

THE TENTH LEPINE EXHIBITION.

THE TENTH LEPINE TOY EXHIBITION.

BY JACQUES BOYER.

The tenth annual Lépine exhibition of toys and small inventions, which was recently held in Paris, was as successful as its predecessors. The Lépine exhibition has become the annual rendezvous of French inventors.

We will first glance at the principal aeronautic novelties. The Rouilot aeroplane (Fig. 4) has two sustaining planes, of equal area, attached to the ends of a longitudinal axis of aluminium. A crosspiece attached to the axis, just behind the forward plane, carries at its ends two propellers made of sheet celluloid, which are driven by the torsion of two stout rubber bands, which are stretched between the propellers and the after end of the axis, where they are twisted by turning a crank, while the propellers are prevented from turning by a strip of celluloid inserted under the axis. The removal of this strip starts the aeroplane on its flight, which may extend 400 feet in a straight line.

Roullot's "pistoplane," which is also illustrated in Fig. 4, is a rudimentary aeroplane which is projected by an equally simple spring pistol. Straight horizontal and inclined flights and curved flights can be accomplished by varying the form and attachment of the spring. This inexpensive toy will not only amuse children, but will give them some idea of the problems of aviation.

Martin's aeroplane (Fig. 1) is far more ambitious and elaborate. It is a complete and practical monoplane, driven by an 8-cylinder Antoinette motor, which uses steam, compressed air, or carbon dioxide and develops about 1/10 horsepower, though it weighs less than 12½ ounces. The frame of the Martin aeroplane and its propellers are made of wood, the fuel tank of copper, the wings of stout canvas. It starts from the ground and is capable of executing extensive flights. The same inventor exhibited a boat 43 inches long driven by a steam engine, having three cylinders arranged radially around the shaft at intervals of 120 deg. The engine weighs

(*Continued on page 487.*)

THE LARGEST SHIP: THE "EUROPA"

A 50,000-TON PASSENGER SHIP

About once in a decade a new fleet of ocean liners is launched, setting a new standard for size, luxury, and safety at sea. The great ships which are thought to express the last word in boat building are soon greatly exceeded by their new sisters, and relegated to a second place. The new fleet now under construction in turn surpasses all the great ships which have gone before. To do them justice, we must find a new vocabulary of adjectives for these super-leviathans and greyhounds of the high seas.

The world had scarcely become accustomed to using the "Mauretania" as a synonym for large objects, when two great ships, the "Olympic" and the "Titanic," were designed to surpass all of her dimensions. No sooner was one of these liners launched, than the owners of the "Mauretania" planned a new ship of even greater length. Now in turn comes the greatest of all ocean liners, the "Europa" of the Hamburg-American Line, which is still larger. With the increase in length, beam, and tonnage, we have a corresponding development in the luxury of equipment. We can no longer call the great ocean liners floating hotels, since the new boats offer many attractive and novel features not yet attempted by the builder of hotels. The new liners have all, even more than, the comforts of a palatial home.

The dimensions of the three latest and largest liners are as follows:

"Mauretania," length 790 feet, tonnage 32,500; "Olympic," length 860 feet, tonnage 48,000; "Europa," length 900 feet, tonnage 50,000.

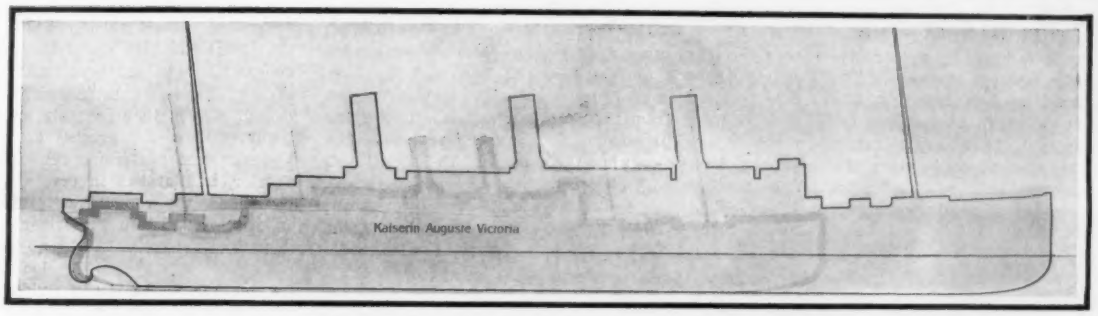
Statistics are likely to be stupid, and the mere recital of dimensions, however large, gives little idea of the overpowering bulk of such a ship as the "Europa." The new liner will have an extreme displacement of between 60,000 and 70,000 tons. In other words, the ship and load weight 140,000,000 pounds. It would, therefore, require 1,400,000 men, or about the population of Philadelphia, each carrying 100 pounds, to handle this material. If it were all loaded upon the largest American freight cars, it would fill a train 12 miles in length, which by the way would extend nearly the length of Manhattan Island. The combined capacity of the three largest hotels in New York city is 3,235 persons, while the "Europa" carries 4,250 passengers.

The "Europa" will have a beam of ninety-six feet, so that her deck will be as wide as Broadway at its widest point. She will have nine decks above the water line, which is the height of the largest apartment houses, thus making her literally a skyscraper afloat. The population of a small city will be comfortably accommodated aboard without crowding, since her capacity will slightly exceed 5,000. The old familiar standards of comparison, such as the height of the Statue of Liberty or the Washington Monument, are completely outclassed.

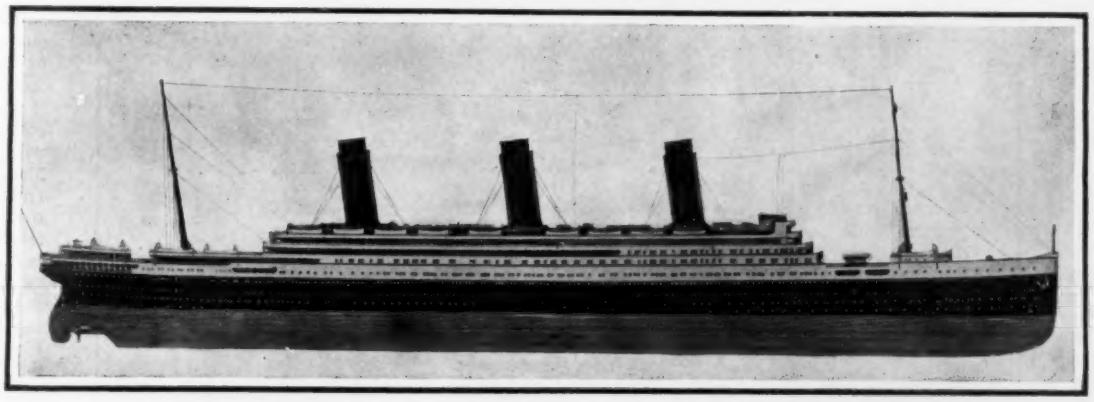
With the laying of the keel of the "Europa," the largest ship in the world now under construction, comes the news from abroad that the gross tonnage of all the ships flying the Hamburg-American Line flag has passed the 1,000,000-ton mark, or to be correct, 1,022,452 tons. Some idea of the enormous size of the "Europa" may be had from the order which has been given for 2,000,000 feet of Oregon fir to be used for the decks alone. For months this lumber has been drying near Portland, Oregon, before being shipped to Germany. Special care has been taken to provide only clear, vertical grain wood, which has been selected with the greatest care.

With the unprecedented amount of cabin and deck space available on the "Europa," a number of unique features become possible which have never before been attempted on a ship. None of the staterooms will be cramped as on the early boats. For all those who care to travel with the comforts of home, there will be complete suites available. There will be a choice of dining rooms for those who do not care for the main dining saloon; there will be a Ritz-Carlton restaurant, a grill room, tea garden, and even a rathskellar. Spacious palm gardens, which in winter may be converted to sun parlors, will occupy the upper deck. Several ladies' saloons finished in different decorative periods will appeal to the tastes of different nationalities. All of these saloons will be connected by telephone to the private staterooms, so that those whose cabins are perhaps two or three city blocks apart, may talk with one another.

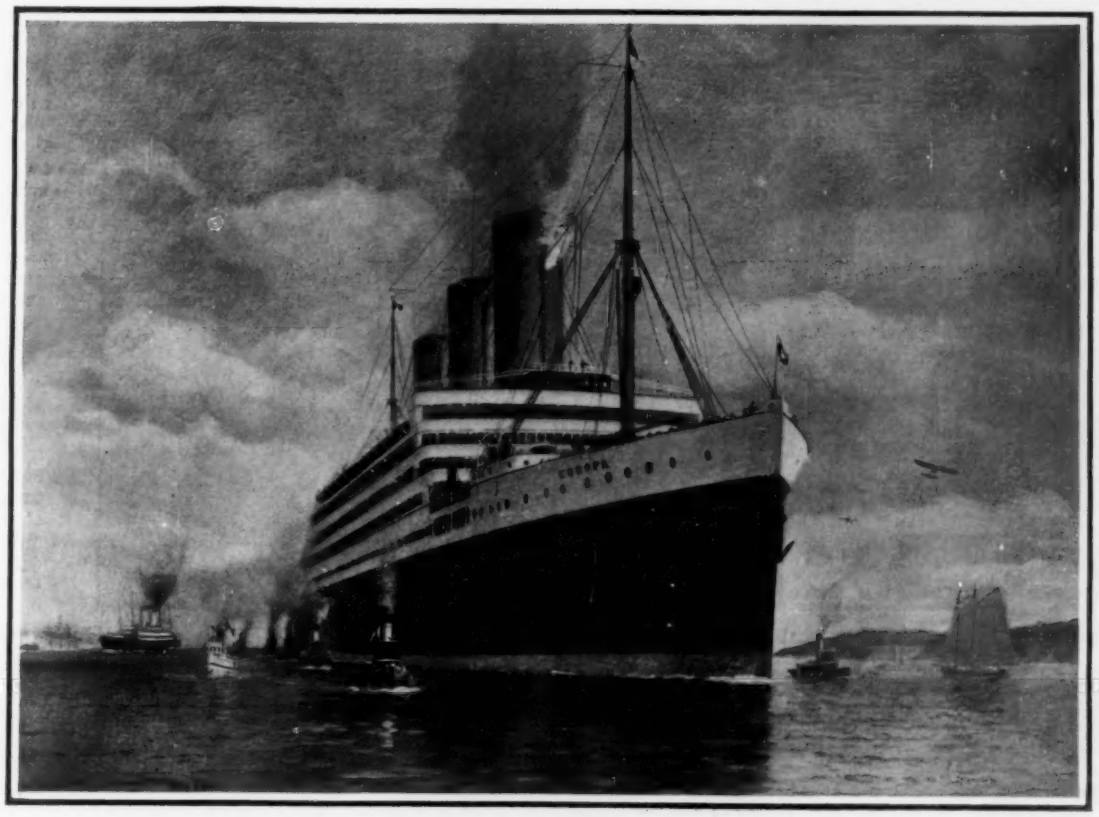
The gymnasium on the "Europa" will be much larger and more completely equipped than any heretofore installed. In addition to the regular apparatus, there will be a running track, so that an athlete could actually cross the ocean without breaking training. The mechanical exercising devices already introduced on some ships will be very complete, enabling one to exercise any set of muscles without effort or enjoy a mechanical camel or horseback ride. An experienced attendant will be in charge of the gymnasium, to offer intelligent advice to those seeking exercise. (*Concluded on page 487.*)



Comparison between the "Auguste Victoria" and the "Europa."



Broadside view of the new 900-foot, 50,000-ton liner, showing the nine decks above water line.



View off the bow of the "Europa" as completed.

THE LARGEST SHIP: THE "EUROPA."

Sacks, Bags, Boxes, Trunks, Milk Cans, Packing Cases, and Escapes Therefrom

BY HEREWARD CARRINGTON

Of late years various performers have created a sensation by escaping, not only from hand-cuffs and manacles of all kinds, but from various other means of restraint—such as those forming the heading of this article. I propose to show, briefly, how the "escape" is effected in each instance—some of them being very ingenious.

There is one style of sack in which the performer is placed, and in which he is fastened by means of a drawer-string, drawn tightly around his neck. The knots are sealed. The most important part of the secret consists in the fact that, at the moment the performer is placed in the sack, he draws a certain amount of the tape in with him, and this gives him enough space to escape from the sack, when released. I shall briefly explain three of a number of "sack tests" that I am able to describe.

In one case, the performer is placed in a sack in the usual way, and it is drawn up over his head, and the rope passed round and round it by the committee, and then tied and sealed. Nevertheless, the performer escapes! This is effected as follows: in the act of drawing the sack over the performer's head, he (the performer) inserts a small bolster or pillow—about six inches long and two inches broad, and made of straw and rags, stuffed very tightly—into the mouth of the bag. The folds are gathered up over this. When the sealing is complete, the performer has only to pull down this pillow, into the interior of the sack, and he is enabled to push his hand through the opening thus left, reach the rope, pull it off entire, and emerge from the sack, shown in Figs. 3 and 4.

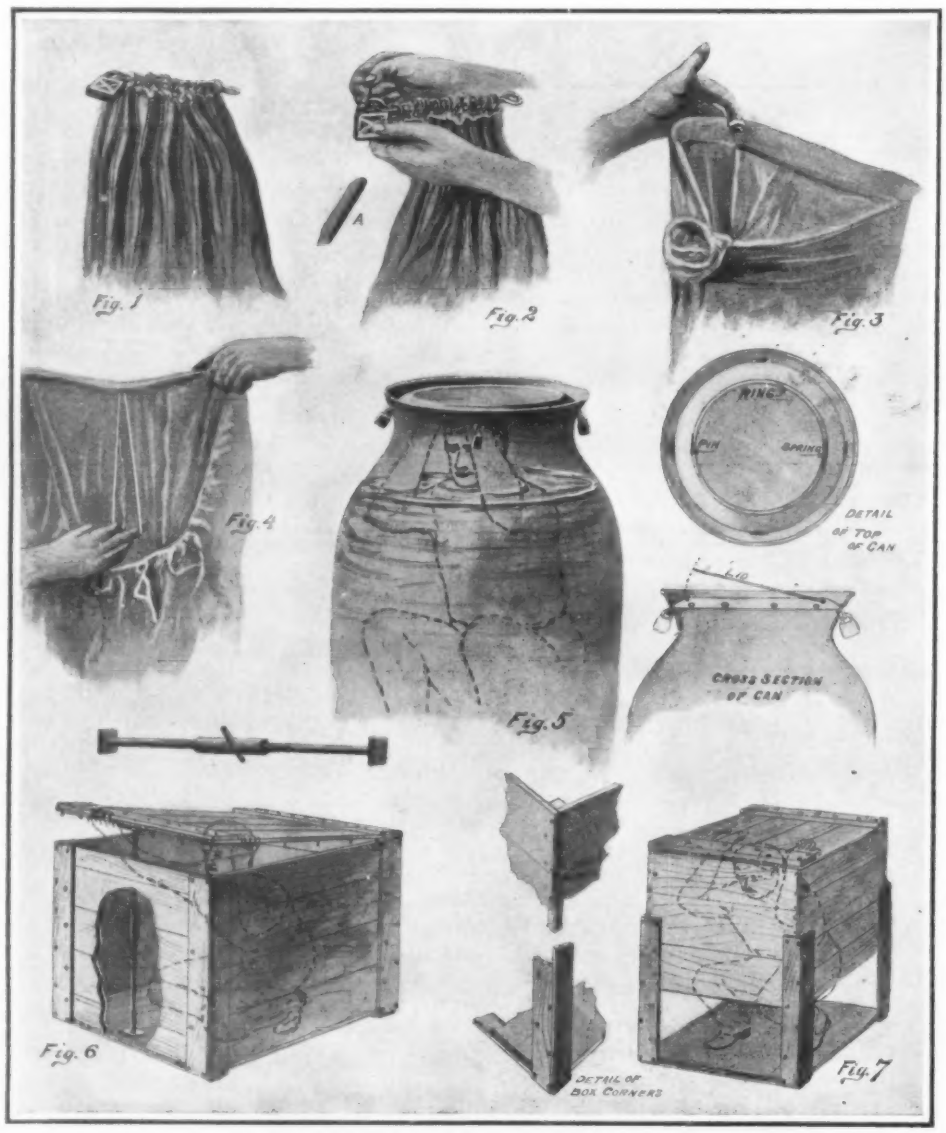
In another sack trick, *two* sacks are employed. The performer is placed in one, and the mouth of the other sack is sealed by the committee. By an ingenious piece of maneuvering, which is hidden from the public, and in which the performer's assistant takes part, the fact is hidden that a second sack is employed.

Still another method is to provide a sack fitted with eyelet holes down the side. These are threaded with laces or strings, and drawn up like a boot or shoe. The secret of the escape consists in the arrangement that one lace is double-ended, and the lower end of this one the performer in the sack unties. He then emerges from the receptacle, through the opening thus left, again laces up the sack, tucks the ends of the lace inside, and he is ready for any amount of inspection!

The escape from what has been termed the "mail bag" is quite ingenious, and very baffling when first seen. A large canvas sack is exhibited, to the rim or mouth of which is sewn a series of iron rings (Fig. 1). This sack may be freely examined. The performer is placed in this bag, and it is gathered together over his head. A solid iron bar is passed through the rings, thereby closing the mouth of the sack effectually. One end of the iron bar is provided with a knob, sufficiently large to prevent the rings from slipping off. The other end of the bar is furnished with a slot, and through this the hasp of a padlock is placed. The padlock is then closed, locked, and the keyhole securely sealed. In this condition, the performer is placed behind the screen, but effects his escape within a few seconds.

There is no trick in the sack, in the bar, or in the method of securing the performer. The trick consists chiefly in the padlock, which must be "picked," after the manner shown in the illustration. When the screen is placed in front of the performer, he places two fingers through one of the loops formed about the mouth of the sack, and, seizing the padlock, pulls it down into the interior of the sack. He then proceeds to open the lock in the manner shown in the engraving (Fig. 2).

A is a special "fake," hidden by the performer, capable of opening the lock if inserted as shown. It pushes back the catch of the lock, and the hasp may be simply pulled open. Once the lock is opened, it is removed from the iron bar, and this allows the rings to be slipped off, and the bar removed altogether, thereby opening the mouth of the sack to its fullest extent, and allowing the performer to escape. When outside, he again threads the bar through the rings, clasps the lock in place, and steps out, carrying with him the sack, which is again offered for thorough examination.



TRICK MEANS USED IN "ESCAPE" FROM VARIOUS TYPES OF RECEPTACLES.

I shall not in this place attempt to describe the means by which the performer escapes from complicated apparatus, the various trunks, cages, etc., that are employed, as this would bring us nearer to an *exposé* of the various stage illusions than to special methods of release from simple methods of restraint. The majority of trunks, barrels, etc., are merely provided with a trap door, which is concealed by a more or less ingenious and complicated mechanism, and which can be found only by pressure upon certain springs, withdrawal of bolts, nail heads, etc. Iron cages are generally provided with two or three bars which unscrew. These being unscrewed and pushed upward, the escape is easily effected.

One or two variations of these methods exist, however, which may require special mention. In one case, the screws fastening the hasp to which the padlock is attached are released from the inside. This enables the performer to open the lid of the trunk and make his escape. As soon as he has done so, he unlocks the padlock with a duplicate key or a "fake," releases the hasp, replaces it in position on the trunk, again screws it in place, and then, closing the lid, he fastens the padlock as at first. This method long puzzled the public, and even that section of the public which was thoroughly familiar with methods of escape from trunks, bags, and similar pieces of apparatus.

Another clever illusion which caused a stir when first introduced, is the following: Any trunk large enough to hold the performer is introduced. He is then placed in it, after donning a mask, the lid is closed. He is then securely locked and roped in the trunk. When the process of tying is half finished, however, the performer runs down the aisle of the theater, and assists in cording up the trunk! This completed, the rope is cut, the trunk unlocked, and in it is found the performer's assistant! There is no trick in the trunk or lock, which could be provided by anyone.

This rather daring and original experiment is performed as follows: When ready for the trick, a committee is invited upon the stage, and while the trunk is being examined, the performer puts on a mask and a robe provided with a hood, which covers his entire person. He then informs the committee that he will step into the trunk, and he asks them to fasten it securely and to tie it with ropes. As the performer mentions the word "ropes," he looks about the stage, and pretends to discover that he has failed to provide them. He steps to the wings, and returns in a moment, carrying a rope with him. He is then fastened in the trunk, and the performance proceeds as described.

As the reader will doubtless have guessed, the performer's assistant, who must be about his size and build, has provided himself with a mask and robe precisely similar to those worn by the performer, and the instant the performer steps behind the screens in search of the rope, he steps out on to the stage, carrying the coil of ropes in his hands. It is *he* who is fastened into the trunk, and it is he who is found in the trunk, at the conclusion of the trick. All the performer has to do, is quickly to divest himself of his mask and robe, and make his way to the rear of the theater, when he runs down the aisle and assists the committee in tying up the trunk. It was, I think, Harry Houdini who first introduced the escape from a milk can, which had been padlocked, and which contained three parts water. The milk can used is a large railway milk can about three feet six inches high, provided with a circular, hinged lid (Fig. 5). Soldered to this lid are several hasps, through which are placed padlocks, which are locked and sealed. Before the performer is introduced, the can is filled about half full of water, so that, by the time the performer is in the can (in a bathing suit) the water has risen up to his neck. The lid is then closed and locked, yet escape is made within a very few moments, the performer emerging dripping wet.

The explanation of this release is, as usual, remarkably simple when once the secret is known. In the lid of the can, a small, invisible hinge and spring are fitted, hidden by a strip of metal running around the inside of the lid. The opposite side of this circular opening is closed by means of a spring catch, also hidden by the metal strip. When the lid is locked upon the performer and the screen placed in

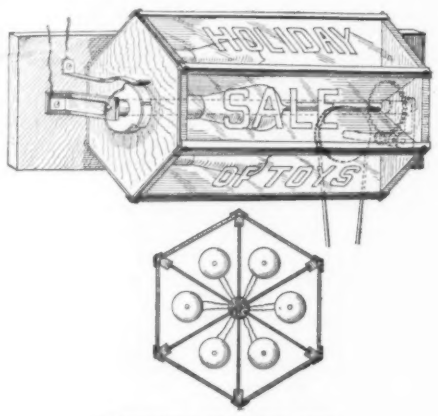
(Continued on page 489.)

HANDY MAN'S WORKSHOP

HOME-MADE DISPLAY SIGN.

BY C. R. M'GAHEY.

Pictured i the accompanying engraving is a novel electric sign constructed by the writer, which makes a very attractive decoration for the store window. It consists of a small, round wooden shaft, on which



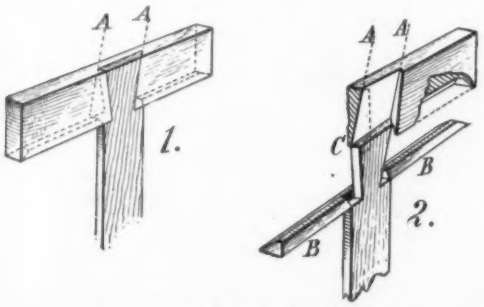
REVOLVING ELECTRIC SIGN.

are fitted two wooden hexagonal end pieces. These are connected by six wooden strips, one at each corner. Each strip has a saw kerf in it, extending from one end to the other. The center rod is also provided with six kerfs mating those in the peripheral strips, and tin partitions are inserted in these kerfs, as shown clearly in the sectional view. Six pieces of glass are fitted to the strips, being held in place by means of metallic cap pieces, permitting them to be slid out at either side if desired. The shaft is fitted with two metal pins, one at each end, to provide a good bearing. The sign is revolved by means of worm gearing connected with the shaft and driven by a small motor. The glass slides of the sign may be decorated in any fashion desired. Within the compartments of the sign, electric lamp globes are placed. These may be either clear or of any color desired. A good plan is to place three lamps in each compartment, each of a different color, so that different color effects may be produced. The lamps are all grounded, so to speak, to one of the pins at the end of the center shaft, and this, as will be observed in the illustration, projects through its bearings and bears against a leaf spring, forming one terminal of the line circuit. Mounted on the projecting portion of the shaft is a commutator or a series of commutators, with which the other terminals of the lamps are connected. A brush bearing against this commutator completes the circuits. The commutator sectors are variously connected with the lamps, so as to provide any desired color effects, as the sign revolves. It is preferable to provide a break in the circuit as each glass slide moves to or out of the reading position, so that the eye will not be confused; but as each sign comes into view, it will flash out abruptly, thus attracting attention.

A WRINKLE IN DOVETAILING.

BY ALBERT F. BISHOP.

The T-square shown in Fig. 1 of the accompanying engraving is a most puzzling bit of dovetailing to the



A PUZZLING BIT OF DOVETAILING.

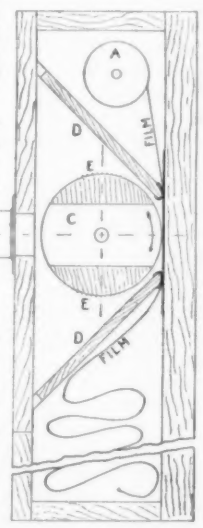
uninitiated. The blade is secured to the head by a joint that is dovetailed in two directions, which seems quite impossible unless the parts grew that way. Fig. 2 reveals the secret. There are three pieces, instead of two, in the make-up of the T-square, one being so fitted that the joint follows the edges of head and hence is not liable to be detected. This piece is used to cover a gap that would otherwise show in the head under the blade. The cut through the head is inclined, the dotted lines *A A* being parallel, which permits the dovetailed end of the blade to be slid in endwise and be brought up flush with the upper face of the head. The narrow lower side of the head is gouged out to receive the strip *B* which, as explained above, joins the head along the edges where the joint, if properly made, will easily escape detection.

HOW TO MAKE A MOVING-PICTURE CAMERA.

BY C. G. HARCOURT.

The drawing herewith shows a sectional elevation of a moving-picture camera, such as any amateur can build for himself. *A* is the spool of unexposed film. *B* is the lens, which should be mounted at its focal distance from the film at the back of the box. *C* is the cylinder or drum, which intermittently moves the film forward, and at the same time acts as the shutter making the exposure. *D, D* are partitions slipping into grooves, to prevent the light from striking the film before and after exposure and to be withdrawn for inserting the film, which passes behind the cylinder *C*, and slides along over a piece of black velvet glued to the back of the box as shown. The partitions *D, D* are covered with velvet on the ends, as shown. These are slid into place so as to touch the film very lightly, just enough to prevent the light from fogging the film, but not enough to prevent the film from slipping past the edges of the partitions *D* down into the bottom of the box, where it lies in folds as shown.

As the cylinder *C* is revolved in the direction of the arrow, the little pin points shown at *E* catch into the film, and draw the next portion down from the reel, at the same time pushing the previously exposed portion down into the bottom. After the pins have accomplished their work, the film is momentarily brought to rest and is exposed by the opening through the center of the cylinder. The same operation is repeated by the other half of the cylinder.



HOW TO MAKE A MOVING-PICTURE CAMERA.

The apparatus is designed for photographs 1½ x 2 inches. The cylinder *C* is made from a block of pine 3½ inches square and 6 inches long. First bore a ⅝-inch hole through end to end; put in the lathe, and turn down to 3¼ inches outside diameter by 5 inches long. Next mortise the through opening and the center as shown, which is 1⅝ inches along the diameter by 2 inches. Better mortise from each side and meet at the middle. Insert eleven pins, or preferably needle points, on each side at right angles to the opening. Insert the first points exactly on the center line, then five more points at each side, spacing them ⅛ inch apart as shown. Do not let them project over 1/16 inch. This will require 44 points, and the rows should be 2¼ inches, or a little more than the width of the picture apart. Slit the velvet at the bottom where the rows of pins pass, so that the cylinder may revolve easily. Insert pieces of ⅜-inch brass rod 3 inches long into the holes bored in the ends of the cylinder and secure tightly. These rods support and revolve the cylinder. Make a box as shown in the cut, 30 inches long, 3½ inches front to back, and 5 1/16 inches from side to side, all inside measurements. Before nailing together, bore the holes for the cylinder shafts so that their centers will be 1 11/16 inches from the inside of the back and 6 inches from the inside of the top of the box; also cut the grooves for the partitions *D*, which are ⅛ inch wide by 2/16 inch deep, and glue the velvet in place at the back. The upper portion of the front, carrying the lens, is made removable in order to load the camera.

All joints should be made light-tight by gluing strips of black paper over them on the inside, after which paint a dull black color. Legs are to be screwed to the box to support it firmly. Guide tacks can be driven along each side of the film, to keep it well centered during operation. A small pulley should next be mounted on one end of the shaft by the revolving cylinder and be driven by a belt from a larger pulley, furnished with a crank, secured to the side of the box lower down. The speed increase should be 1 to 3. Two nails inserted through the sides carry the spool of film.

To develop the film, it will be necessary to use a frame with two slotted rollers mounted at each end, and provided with little wire cranks by which they may be turned. The writer has made many successful strips of negatives with this apparatus.

ENLARGING A TAPPED HOLE AND REDUCING A SCREW.

BY J. A. BERGSTROM.

TO TAP A HOLE LARGER THAN THE TAP USED.

After a nut is tapped, should it prove too small for the bolt it is intended to fit, it may easily be made larger. A small piece of tin is placed over the end of one or two rows of the threads of the tap, as shown in Fig. 1. The tap is now "run through" again, and it will be found that the piece of tin crowds the tap to one side and cuts a considerably larger hole than before. If the nut should not prove large enough now, another piece of tin may be placed over the first one, which has assumed the shape of the threads. These operations may be repeated until the right size is obtained.

If a solid die is used in cutting a bolt, and the

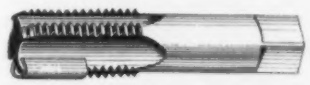


Fig. 1.—TAP FITTED FOR ENLARGING A SCREW HOLE.

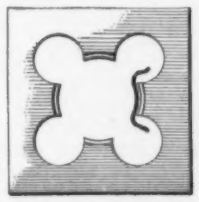


Fig. 2.—DIE FITTED FOR REDUCING A SCREW.

threads prove too large to fit the nut, a piece of tin may be placed in the die, as shown in Fig. 2, and the operation repeated as before described until the right size is obtained.

If the threads in a tapped hole are stripped, they may be recut by using the method outlined above. This will only freshen up the threads, and make them larger, so that a new bolt will be required; but if it be desired to use the same old bolt, the bolt must be made a little larger in diameter. This is done either by hammering the bolt flat, until it fits the hole, which will answer all purposes until a new bolt is procured, or one or more of the strips of tin used in enlarging the hole may be placed in the hole and the same old bolt used. This will make nearly as good a job as if a new bolt were used. A nut can also be made smaller by flattening it so that it will fit the bolt. A large nut that has been stripped can be made smaller by cutting a piece out with a hacksaw, and then riveting together again. Another way to make a nut smaller is to heat it and apply to the threads some cyanide of potassium.

Of course, for ordinary nuts, these operations would not pay; but they could be applied to special nuts, such as would be too expensive to replace, or in places where repairs *must* be done, and done quickly.

THUMB-INDEXING A BOOK.

BY W. J. C.

The advantages of having certain books, such as reference books, catalogues, etc., thumb-indexed will appeal to everyone who ever has occasion to consult such volumes for information in a hurry. Few published books come indexed in this manner, and considerable time is lost in looking for information contained therein that could be saved if they were properly thumb-indexed.

The following simple method of thumb-indexing will be found very satisfactory:

Procure a small-sized paper clip of the type shown

TOOL USED FOR THUMB-INDEXING A BOOK.

in the engraving and remove the two small jaws, saving the spring. Procure a piece of ½-inch pipe, and for a distance of about ¾ of an inch file it down on the outside until a slight shoulder is formed. The spring of the clip is then opened slightly and sprung on the pipe as illustrated. This forms our cutting tool, after an edge has been put on the end of the

spring. This can be done on an oil or carborundum stone. The spring will be found to take a very sharp cutting edge and to hold it well. Before cutting the edges of the book, go through the latter and place a paper marker at the subject matter you desire to index; and having decided on your subjects, you can best arrange your cuts. The length of the book from the top to bottom of the page, and the width of your cutter, of course, determine the number of indexes you can get in line; but having arrived at the bottom of the page, start at the top again, and continue so through the book.

To cut, proceed as follows: Suppose you wish to locate the information on page 15. Open your book at the desired page and close to the top, if it is the first index, mark where your first cut comes. Hold pages 1 to 14 flat, and cut back toward page 1, care being taken that the cut is not made in a vertical direction, but out toward the edge of the cover. The latter, of course, must not be cut into, and if the first cut is close to the first page, a thin piece of wood should be inserted to protect the cover. The depth of the cut from the edge in should be regulated by the number of characters to be written in the index. The next mark is now taken, and a similar cut made at the next page to be indexed, lower down on the page. A glance at a thumb-indexed dictionary will show at once how the cuts are made. If the cutter is kept sharp and the cut is made with one blow of the hammer, the edges will be perfectly smooth; but should they become irregular, they can be smoothed down by rubbing the thumb slot with fine sandpaper on a round pencil, the leaves being held close together in the meantime.

HANDY CENTERS FOR LATHES.

The sketches reproduced herewith show the way in which centers can be made for the lathe. These centers will be found very handy for drilling holes in round stock.

Take an old center, and turn one end down as shown in Fig. 1. A V-block is then made, and a hole is drilled in the center, as shown. This hole is to be a driving fit on the center. When the center is to be used, it is placed in the tail stock, and the work is to rest against the V-block. This will hold the work central, and prevent it from turning while the hole is being drilled.

Fig. 2 shows another style of center which may be used for centering work. The device is made as illustrated; and has a 60-deg. taper in the end. When there is work to be centered, the center is placed in the lathe, and the stock is then set in it; the center being tapered will of course cause the stock to find its own center. The hole can then be drilled concentrically with the circumference of the work.

Fig. 3 shows a handy device for holding small drills in lathe work. This device will take drills

Fig. 1.—CENTER FOR DRILLING ROUND WORK TRANSVERSELY.

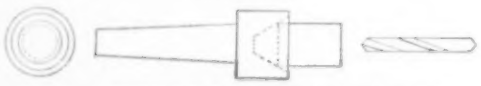


Fig. 2.—CENTER FOR DRILLING ROUND WORK AXIALLY.

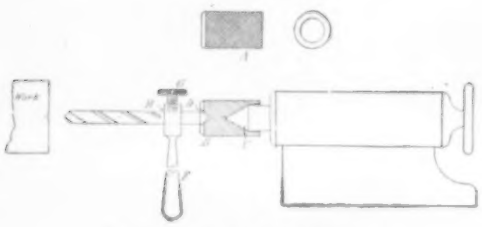


Fig. 3.—CENTER FOR A DRILL.

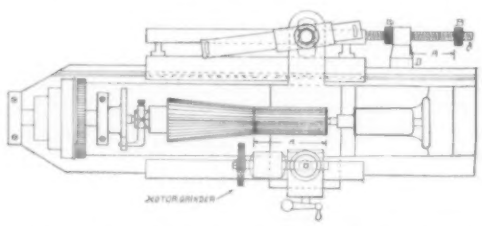
running from 0.10 inch to ¾ inch. *A* represents a side view of the center; and *B* is a sectional view. It is made of round tool steel, and knurled so as to be easily handled, and is provided with female centers at both ends. The center *C* is larger than that at *D*. A hole is drilled in the end of the center at *C*, as shown. This will allow the center to hang over the end of the center of the tail stock. The center is reamed to a 60-deg. taper, so it will fit the lathe center in the tail stock. The hole *H* is drilled large enough to accommodate the largest drill that will be used in handle *F*. The screw *G* is made of tool steel, and is screwed in the end of handle *F* to prevent the drill from turning in the handle while in use.

This centering fixture has proved to be a handy tool, and will not take up much room in the tool chest.

GRINDING A STRAIGHT-END TAPER REAMER.

BY H. B. CHAPMAN.

It is often amusing to find how simply some apparently hard problems are solved. The writer was once confronted with the job of grinding a taper reamer, as shown herewith. The reamer was straight for two and a half inches, and then tapered for about the same distance. The taper was probably at least two inches to the foot. Grinding off the straight blank was a simple matter; but to grind the straight blank and taper part without leaving a shoulder was quite



SIMPLE METHOD OF GRINDING A STRAIGHT-END TAPER REAMER.

a different proposition. It seemed best to do the job on a lathe, as follows: A center grinder was procured and placed in the tool post as shown. By adjusting the clamp *D* to the proper position, and then backing up the nut B^1 (a distance equal to the straight part of the reamer blank) it was found to work quite satisfactorily. By looking at the sketch, it will readily be noted that as long as the screw *C* is free to pass through the clamp *D*, the work will be ground straight; but as soon as nut B^1 strikes clamp *D*, the cross slide will then take the course that the taper attachment is set to.

The reamer ground in this way had the required taper, and there was not the slightest trace of a shoulder at the beginning of the taper.

Shop Notes.

Soft-soldering is not considered a very mechanical way of fastening machine parts, but it sometimes helps one out of a difficulty in a surprising manner. Over a year ago the writer had the job of repairing a lathe on which the main driving gear was loose on the spindle. The spindle was hollow, and so thin that it did not furnish a good support for the key. The gear, spindle, keyseat, and key were cleaned and carefully tinned. They were then heated hot enough to melt the solder, and were assembled. The lathe has been in hard service ever since, and the gear is still perfectly tight.

A very satisfactory extension drill may be had by taking a piece of iron or brass pipe, whose internal diameter equals that of the hole to be drilled, and with a crosspeen hammer make two dents directly opposite each other and about 1½ inches from one end. Into this pipe drive the twist drill, after having ground the end flat. This is a very good way of driving taps also.

In many small shops the screw machine and other tools are finish-ground on copper laps. These laps are about 10 inches in diameter by about ½ inch thick, and are mounted on the same spindle as the emery wheel. The lap is easily charged in the usual way by using a hardened steel roller and rolling the abrasive into it. Tools finish-sharpened in this way will do much better work, and will last much longer.

To drill a large hole clean from the start without jumping or chattering in the least, take a small piece of old rag or waste about the size of the end of the drill; place it under the point of the drill, and then drill through the rag or waste. This idea may be used to a great advantage in countersinking work which requires a clean finish.

HOW TO BIND SCIENTIFIC AMERICANS AT HOME.

BY JOSEPH N. PARKER.

The following method of binding periodicals does not require any special tools or appliances, everything being found in the average home except the printer's paper knife for trimming the edges. If the knife can be used, it makes a much neater book; however, it is not absolutely necessary.

Arrange the papers in order, a year in each pack, and tie them each way. Then with the back edges perfectly even, cut with a saw three slits at *a*, Fig. 1. The slits should be 4 inches apart and ½ inch deep. Cut again at *f* about 1 inch from each end ¼ inch deep.

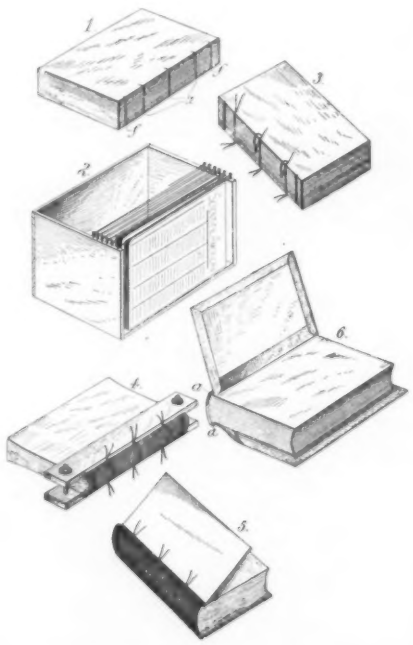
Get a box a little larger than the paper, as at Fig. 2. A tomato case is just the right size. Open it at the top and one side, and drive a row of small-head tacks along each edge ½ inch apart, 26 tacks in each edge. Double some strong linen thread and loop it back and forth over the tacks, making 52 strands across the box. Open the papers at the middle, and hang one on each strand. With a carpet needle run a doubled piece of hemp twine through the sawed slits, being careful to see that the needle goes under the linen thread in each paper.

Carefully take the strands off the tacks, so as not to lose any of the ends. Pick the ends through the small slits at each end of the papers and tie them one to the other, so that the knot will fit down in the slit. Tie the first and second together, the end of the second and third, the third and fourth, and so on. When tying them at the other end, be sure that the threads are not loose inside the papers. Lay the pack on the side, and with the needle run the ends of the hemp twine back again through three or four papers, as shown in Fig. 3. Do this with each piece of twine, so as to keep the papers together securely. The ends and front edge of the pack should now be trimmed with a paper knife, but keep the back edges perfectly even while cutting. Clamp the pack between two boards with bolts, as shown in Fig. 4. The boards should be about 5 inches wide and not less than 1 inch thick. Let the edge of the boards come just to the slits, and draw the bolts down as much as the board will allow. This will cause the back edge of the pack to bulge, and take on the characteristic curve of a book. See that the hemp strings are drawn up securely again.

Make a flexible paste as follows: Chloral hydrate, 5 ounces; gelatin, 8 ounces; water, 20 ounces. Let it stand for 48 hours, and pour off the clear liquid. Rub the back edges of the papers well with the paste, and see that it goes down in between them a little. Lay on them a strip of cheese cloth 13 inches long and 9 inches wide. Rub paste on this also, so that it will go through the cheese cloth, and fasten it to the edges of the papers. The ends of the hemp twine must be stuck through the cheese cloth. Leave the papers in the clamp over night, or while another pack is being assembled on the linen strands.

Cut four boards for each book, ¼ inch longer and of the same width as the pack. Uneeda biscuit cases make excellent covers, and any grocer will gladly supply them. Lay a strip of paper under the flap of cheese cloth, so that it won't stick to the first page of the papers. Rub paste on the cloth, lay on one of the boards, rub paste all over this, and carefully arrange the ends of the hemp twine with a good supply of paste (Fig. 5). Put paste on another board, and lay on the first with the hemp ends between. Turn the pack over, and repeat the operation on the other side.

Black sateen makes a good covering, but almost any kind of goods not too stiff or thick will do. Fold the cloth and cut it 3 inches longer and 3 inches wider than the book. Rub paste on the outside board, and lay one end of the cloth on it with the edges overlapping about 1½ inches. Pass the cloth around on the other side, and paste down. Clip the corners and



HOW TO BIND SCIENTIFIC AMERICANS.

paste down the edges, letting it fold under the corners of the board and double around the back edge of the book. (*f*, Fig. 6.) Lay a folder flyleaf on the book, rub paste on the top side, and press the cover down on it. This will hide the pasted edges of the cloth and cheese cloth.

A colored front of one of the special numbers pasted on the front cover makes the finished work a handsome volume.

ANNOUNCEMENT BY

THE UNIVERSITY OF CAMBRIDGE (England)

In all English-Speaking Countries, in regard to the New (11th) Edition of the

ENCYCLOPAEDIA BRITANNICA

A New Edition of the Encyclopaedia Britannica, the ELEVENTH (the First having been issued in 1768-71), is about to be published by The Cambridge University Press. No completely new edition has appeared since the Ninth, which was issued volume by volume between 1875-89. The copyright and control of this celebrated work having passed into the keeping of the University of Cambridge, it will be issued henceforth as a University publication. The new (11th) Edition will consist of 28 volumes and Index, containing 27,000 pages and about 40,000,000 words of text. The entire work will be issued simultaneously—soon after the New Year—and advance subscriptions (at substantial concessions in price) will now be accepted, but no remittance need be sent until after delivery of the volumes.

THE WHOLE OF THE MS. WRITTEN SIMULTANEOUSLY.

The new (Eleventh) Edition of the Encyclopaedia Britannica is the only work of any magnitude ever written as a complete whole. Practically the entire contents have been under the editorial eye before a single page was sent to the printer, the contributors having been at work simultaneously with a common purpose. In the past, the Encyclopaedia Britannica has been produced volume by volume, each having a different date from the others. In the case of the Ninth Edition, the interval between the completion of the first and the twenty-fifth volume was fourteen years.

CONTINUOUS EDITORIAL CONTROL.

A decided advantage over its predecessors consists of the fact that, in the case of the Eleventh Edition, a large and exceptionally efficient editorial staff has been engaged continuously during eight years in directing the work of the contributors. All the volumes are of an even date (1910), and the information under each heading is complete and individual and does not appear elsewhere even in a different setting.

CURRENT INDEXING.

As the 40,000 articles in the Eleventh Edition came in, they were analyzed and their contents were indexed. Repetitions and inconsistencies were in this way eliminated and a view of our knowledge was presented that is complete, harmonious, and trustworthy to a degree that would have been possible by no other method. The editors estimate that the Eleventh Edition of the Encyclopaedia Britannica contains twice as much information as the Ninth, in little more than the same space.

QUICK REFERENCE.

The new edition combines comprehensiveness of treatment with brevity of treatment wherever the convenience of the reader seemed to the editors to demand it. Exhaustive expositions of major subjects are given as before, but in thousands of cases minor subjects are dealt with separately and in their alphabetical place. These short articles are very numerous, leading the inquirer directly to the information he seeks, so that the Encyclopaedia Britannica (Eleventh Edition) will be found to be the most useful work for the purpose of quick reference that has even been published.

NOTICE

Announcement of the forthcoming publication of the new Eleventh Edition of the Encyclopaedia Britannica was made in the United States in the November magazines, and subscriptions for this new edition at substantial concessions in price were invited in advance of publication, but without immediate payments. As over 4000 orders have already (Dec. 9) been registered in the United States and only five thousand sets on India paper are being printed at first, it is evident that the orders received before Christmas will more than account for all sets of the first printing. Those, therefore, who desire early delivery—that is, as soon as the first impression is ready—should register their names at once. It will be necessary in the case of applications received after the first printing is exhausted to open a waiting list, delivery to be made as soon as the volumes can be again printed and bound. Each subscriber's name will be registered and each set delivered according to the date of application as indicated by the postmark. From this rule there will be no departure.

¶ **The 1,500 Contributors** include Chancellors, Presidents, Professors and Lecturers of 81 universities and colleges in all countries—besides men of action, soldiers, sailors, men of affairs, jurists, administrators, archæologists, surgeons, physicians, editors, artists, inventors, explorers, engineers, sportsmen, manufacturers, and financiers, as well as hundreds of

¶ **Practical Experts,** who may be said to have paused in their activities to give of their experience. Many articles abound, therefore, with exclusive information, which will be the basis for the doings and

¶ **Many American scholars and experts** (besides French, German and Italian) were held to have supplanted all others in certain branches. "Feudalism," for example, has been dealt with by Prof. G. B. Adams of Yale; "Climatology," by Prof. R. de C. Ward, of Harvard; the "History of Ancient China," by Prof. Hirth, of Columbia; "Mahommedan Law and Institutions," by Prof. D. B. Macdonald, of the Hartford Theological Seminary—and 64 articles connected with Persian history have been written by Prof. Eduard Meyer, of Berlin—to cite only a few of such cases.

¶ **The articles on Archaeology** possess extraordinary interest, inasmuch as they are based on the knowledge of the men who did the work of recent excavations—in Egypt, Babylonia, Rhodesia, Mexico, Central America, Peru and elsewhere—and never before published. They are supplemented by many valuable plates.

¶ **An index to the world's books** is provided by the simple means of appending to every article of importance a list of books worth reading in connection with it. Thus the *Encyclopaedia Britannica* (11th Edition) is now not only a great work of reference in itself, but an index to the most valuable literature. In completion of this idea there are full and concise bibliographies—

¶ **The historical bibliographies** constituting a *catalogue raisonné* of the whole mass of historical literature extant. The excellence of this work may be gathered from the fact that the bibliography of the history of France—five columns of small type—was prepared by Dr. Charles Bémont, who is probably the foremost of French historians; that of English history, by Prof. A. F. Pollard, of the University of London; that of Greek history—fourteen columns—by the Rev. E. M. Walker, one of the most successful of Oxford tutors; and that of Roman history, by Mr. Stuart-Jones, of Oxford, on whom has fallen the mantle of the late Prof. Pelham. Inasmuch as the

¶ **Contributors were put at work simultaneously,** their attention was directed to the work as a whole, and their manuscripts were analyzed and indexed before a single page was sent to the printers. In the case of the Ninth Edition, the interval between the appearance of the first and the twenty-fifth volume was fourteen years. In the case of this edition,

¶ **The 28 volumes and Index are to be issued simultaneously,** so that the work will be of uniform value to the reader. The piecemeal method of publishing was satisfactory only to the publishers, who issued each successive volume with the proceeds of the sale of the preceding one.

¶ **£163,000 ($815,000)** has been the editorial expense of the new (Eleventh) Edition, as against £60,000 of the Ninth, and the total expense, including the cost of maps, colored plates, illustrations, type-setting and office expenses, has amounted to £230,000 ($1,150,000) before a single copy is sold.

¶ **A Complete Classical History** is comprised under more than five hundred headings, and for the first time in the *Encyclopaedia Britannica*,

¶ **Biographies of Living Persons** are included, so that the reader may be acquainted with celebrities of all nationalities down to the present day.

¶ **The new knowledge** gained during the last 25 years has been dealt with most exhaustively, especially with regard to Science and Geography. All countries that have sprung suddenly into political and commercial importance are particularly considered at length.

¶ **Modern Africa,** for example, with its history, geography, geology and ethnology, is treated by experts in 43 pages; Japan in 100 pages, and China in 68 pages. Indeed, it may be said that the collected articles on each of these, as on many other subjects, would form separate books averaging 100,000 words each. Its comprehensiveness, in this respect, makes the *Encyclopaedia Britannica* (11th Edition) also

¶ **A Handbook of Commerce and Finance,** a handbook of Astronomy, Botany, Medicine, Theology, and Law, in every case the articles on these subjects being the work of authorities. It is a practical work for the modern man of action written in language that is simple and sufficient, and further made attractive by

¶ **Over 7,000 Text Illustrations, all** of them specially prepared to suit the articles they accompany. Of the widest possible range of interest are the

¶ **450 Full-page Plates**—many of them in colors—which cover not only processes of manufacturing, shipbuilding, and industrial, scientific, and engineering subjects, domestic animals, etc., but works of art and applied art. Full-page plates are devoted to specimen examples of Greek, Egyptian, Roman, Japanese, and Chinese art, to Ceramics, Lace, Embroidery, Furniture, Mural Decoration, Orders, Process Printing, Photography, Precious Stones, Tapestry, etc.—to all subjects, in fact, in which the choice of authoritative pictures will be likely to inform the reader, and confirm the authority of the text. Of the

¶ **417 Maps,** some of them in as many as twelve colors, it will be interesting to know that the names of places, for the first time in any work of reference, correspond exactly in spelling to those referred to in the text. Finally, the new *ncyclopaedia Britannica* is in no sense of the word a heavy book; a volume can be picked up between thumb and finger and held in one hand, and the covers can be bent back on themselves without risk of injury, for by the use of

¶ **India Paper, with Flexible Leather Bindings,** each volume is now *less than an inch thick*, though containing 960 pages. The whole set of twenty-eight volumes and Index will only take up about 2 feet of shelf space, and so could conveniently be put on occasional tables, in the same way as novels, books of verse and periodicals, ready to earn the gratitude of all who have leisure moments.

¶ **The Price,** instead of being more than that charged for volumes of the last edition, is very considerably less.

THE LIST IS OPEN FOR ADVANCE SUBSCRIPTIONS.

The new edition is now being printed, and the first copies will soon be ready for delivery. The work, in 28 volumes and Index, will be in two forms:

(1) On INDIA PAPER (very light and opaque), in Three Styles of Binding—CLOTH, FULL FLEXIBLE SHEEPSKIN, and FULL FLEXIBLE MOROCCO, the volumes to be less than an inch in thickness (about 960 pages).

(2) On ordinary book paper, in Three Styles of Binding—CLOTH, HALF MOROCCO and FULL MOROCCO, the volumes to be 2¾ INCHES THICK (about 960 pages).

By the employment of India paper (and a corresponding lighter binding in Flexible Leather) the volumes have been reduced to ONE-THIRD of the bulk of the Ninth edition volumes, without any sacrifice of strength or durability. The volumes of the Ninth edition were 2½ inches thick. The volumes of the Eleventh edition (India paper impression) are less than an inch in thickness (about 960 pages), the entire set occupying little more than two feet of shelf space.

$4.00 A VOLUME FOR ORDINARY PAPER, BOUND IN CLOTH.

This is little more than half the price (30s., or $7.50 a volume) at which the Ninth edition was sold when first issued, although the number of pages in each volume is larger by 100, the number of articles in the whole work by 25,000, the number of contributors by 400, and it is estimated that the body of information has been increased by at least 100 per cent.

The slight additional cost (25 cents) for the India paper volumes is not in proportion to actual market valuation, as it is well known that books printed on India paper are always sold at high prices.

TO BE INCREASED TO $7.50 A VOLUME.

It is intended that after the publication of the work, the price shall be increased, and this increase will be made at any time after the purpose of the present offer has been achieved; the work will ultimately be sold at the regular price of 30s. or $7.50 a volume (cloth).

PAYMENT AFTER DELIVERY.

No money need accompany advance subscription, nor will any payment fall due until the volumes have been delivered.

NUMBER OF EARLY SETS AVAILABLE.

Before proceeding with the manufacture of a large number of copies, the publishers wish to ascertain approximately the relative demand for the work in its two forms and six styles of binding, and until this information has been secured only a small number of sets will be printed and bound. The first subscription list will, it is evident, account for all the sets now in process of manufacture. Subscribers whose applications are entered on this list will be placed on a basis of preferential treatment, that is, will receive the large concession in price above explained.

Those who prefer the India paper impression are particularly urged not to delay their applications, as the preparation of the sets in this form is a slow process.

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APPLICATION FOR THE PROSPECTUS.

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RECENTLY PATENTED INVENTIONS.

Of Interest to Farmers.

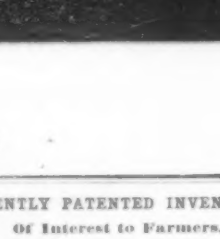
CULTIVATOR.—F. P. ECKROAT and P. F. ECKROAT, Shawnee, Okla. The cultivating mechanism here consists of hoes, and means for operating them in a manner resembling as closely as possible that of manual hoeing. Springs retain the cultivating mechanism in position, but with a yielding pressure, and either mechanism may be lifted entirely out of contact with the ground, to avoid an obstruction without stopping the operation. Messrs. Eckroat have invented another cultivator, wherein the operating mechanism consists of a plurality of hoes, and means for moving the hoes in a manner closely resembling the manner of use of a normally operated hoe.

PLOW ATTACHMENT.—B. A. MORRIS, Newbern, N. C. This inventor provides a gage which may be attached to a plow to be operated on either side of the plow as required to enable the operator to make straight or regular rows or furrows. The device may be readily attached to any form of plow, and may be moved from one side to the other with ease.

WING-CARRIER.—W. F. BROWN, St. Paul, Minn. This invention provides lateral wing carriers for threshing and like machines, which may be universally mounted upon the majority of such machines of the present standard makes, and which may be detached therefrom; provides a carrier which may be retracted into a position where there is no interference when the machine is moved to and from the location in which it is operated; provides means for adjusting the carriers to receive from points within a certain radius, which adjustment can be made as, and when the machine is in operation; and provides devices whereby material may be advanced and automatically released at a given point.

Of General Interest.

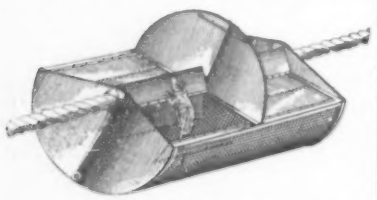
KEY RING.—J. A. PRIGGE, Jr., 112 Hudson Street, New York, N. Y. A novel key ring has been invented by Mr. Prigge, which is unique in providing separate portions to retain keys for distinct uses. As shown in the illustration, the ring is divided into three parts, in one of which the business keys may be held, while in the other keys for miscellaneous pur-



KEY RING WITH SEPARATE SECTIONS.

poses may be secured. The third portion is fitted with a plate on which the name of the user and his address may be engraved. It will be observed that the ends of the key-supporting sections are turned inward so that there is no danger of their catching in the pockets of the user.

RAT TRAP.—W. S. WARD, Box 111, Bonners Ferry, Idaho. This rat trap is of a type adapted to be suspended on a cable or hawser so as to intercept a rat as it travels from a dock to a vessel. The trap, owing to its eccentric suspension, is kept face up, and is provided with a barrier which will prevent the animal from crossing without passing on to the doors of the trap. At the point of suspension, skids are provided which will slide the animal on to the doors to either side of the hawser.



RAT TRAP FOR CABLES.

CONVEYER-LINK.—A. R. LAUBENSTEIN, Ashland, Pa. In the present patent the invention has reference to conveyers, more particularly to flight conveyers, and has for an object the provision of a conveyer link, the parts of which are detachably assembled so that any individual part can be renewed and a new part quickly and easily replaced.

BAR APPLIANCE.—W. JANSEN, New York, N. Y. The particular purpose here is to provide an attachment to be used in connection with taps for barrels, especially beer barrels. As well known, barrels containing beer also contain gas under pressure and it is desirable that gas shall not be allowed to escape. It is also desirable in many instances to pump air into the beer barrel under pressure.

HAMMOCK-HOOK.—F. R. ELDRIDGE, New York, N. Y. This invention is an improvement in hooks for use in attaching the suspending cords to a hammock, particularly navy hammocks for enlisted men of the navy service, which consists of a length of canvas having eyelets in the hem at each end, and which is provided with means for overcoming many former disadvantages of hammocks.

DRAFTSMAN'S TABLE.—H. COTS, San Jose, Costa Rica. This inventor provides a construction whereby the body of the table may be readily adjusted to various inclinations while maintaining in horizontal position a display shelf and structural elements connected therewith; provides a receptacle for holding ink on the tilting platform, and means for preserving the vertical disposition of the receptacle; and provides means for elevating the table and locking the same in adjusted position.

LUBRICATOR.—J. A. COPPERS and E. E. BOOTH, Denison, Texas. The aim in this case is to provide a lubricator for locomotives and for steam engines, which may be attached to the steam chest of the engine, with a communication between the said chamber and a second chamber disposed thereunder, there being means to command the communication between the two chambers.

Hardware.

NUT-LOCK AND TIGHTENING DEVICE.—J. G. WOLFE, New York, N. Y. This invention is designed to hold the nut on a bolt against accidental turning, and to automatically tighten the parts fastened together by the bolt, thus taking up all lost motion, or looseness that may occur in parts fastened together, whether such looseness occurs by stretching or expansion of the bolt or the wearing of abutting faces of the parts fastened together or for other causes.

LINE-RULING DEVICE.—E. PICKWICK, Jr., Newark, N. J. The purpose of this device is to facilitate the ruling of a number of parallel lines on a blackboard, slate or wall. Another purpose is to produce a device which will enable a plurality of crayons or markers to be held equidistant for the uses of the invention.

DASHER FOR ICE-CREAM FREEZERS.—M. OHRYNOWEECH, New York, N. Y. This dasher will enforce the rapid traveling of cream from the center of the can upwardly and outwardly to the sides, and also force the cream upwardly and outwardly at the sides as it is scraped from the wall of the can, whereby the freezing of the cream takes place rapidly and uniformly, and thus preventing the cream from freezing and caking at the bottom before that at the center and top solidifies.

Heating and Lighting.

BOILER.—J. G. HAYDEN, New Lexington, Ohio. The boiler is especially useful for supplying hot water to dwellings and the like, and more particularly is adapted to be heated by means of natural gas or by any other suitable heat producing agent. It comprises series of superposed drums, water tubes connecting corresponding drums of the series, and connecting tubes between certain of the drums of each series, so that a thorough circulation of the water in the parts can be effected.

HOSE-DRIER.—F. A. HOYT, Gordon, Neb. This improvement refers to driers for freeing fire hose and the like from moisture, and has reference more particularly to a device comprising means for heating air, means for drawing the heated air from the first means, and means for connecting a hose with the air-drawing means, so that the heated air can be forced through the hose to expel the water remaining in it.

CARBID-LAMP.—S. E. SIMMONS, Litchfield, Ill. An object of the inventor is to provide a device which will be compact and simple in form, containing both the water tank and generator in one receptacle, and wherein the admission of the water may be nicely regulated. Further, to prevent the entrance of sediment to the carbid and to strain the incoming water and the outgoing gas.

Household Utilities.

CURTAIN-ROD.—H. BENOIT, Brockton, Mass. Mr. Benoit's invention refers to curtain rods, and has for its purpose to provide one with hook members, which may be manufactured cheaply, and which are adapted to engage the outer sides of a window casing and be held in position by a spring, which also serves as a means for supporting the curtain.

Machines and Mechanical Devices.

DRIVING MECHANISM.—J. BECKER, Canal Dover, Ohio. The purpose here is to provide a mechanism for washing machines for quickly and efficiently washing materials and operated by a motor, and a wringer attached to the washing machine for wringing the materials that have been washed by the machine, the wringer being adapted to be operated independently of the washing machine but by the same motor used to operate the washing machine.

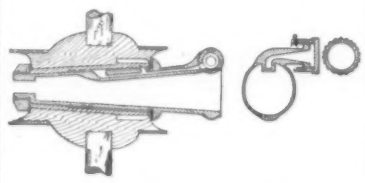
CENTRIFUGAL PUMP.—D. W. BLAIR, New York, N. Y. This invention relates more particularly to the provision of a so-called liquid packing for certain movable parts thereof, the special purpose being to enable the centrifugal action of the pump to oppose or overbalance the tendency of a liquid to escape between a stationary part and a revoluble part, and thereby prevent an escape of liquid which might otherwise take place owing to the looseness of the revoluble part relatively to the fixed part.

AIR-BLAST APPARATUS FOR COTTON-GINS.—O. W. MCDONALD, Rising Star, Texas. This apparatus is designed for cleaning the lint from the saws of cotton gins more effectually and economically than the usual brushes. Nozzles are adjusted to position with respect to the saws by rods and screw-sets, and when the gin commences operation the air is turned on. The current of air acts in the direction of the inclination of the teeth so that the cotton is stripped therefrom and delivered into the receptacle.

SAFETY-STOP FOR SAWMILL-ENGINES.—A. C. DEAN, Overhill, W. Va. The object here is to provide a novel construction in the form of a safety platform upon which the sawyer will ordinarily stand in operating the mill, which platform will be connected with supplemental valves in the steam feed pipes so that the movement of the platform will control the supplemental valves in such manner that when the sawyer steps off the platform the supplemental valves will be automatically closed, shutting off the supply of steam and stopping the feed.

Pertaining to Vehicles.

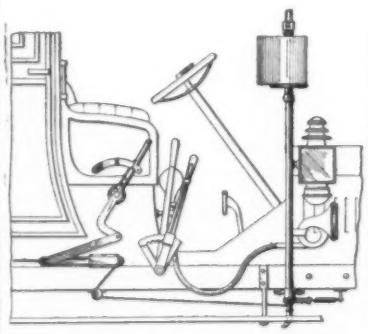
AXLE LUBRICATOR.—C. EMERSON and J. PETERSON, 2823 30th Ave., South, Minneapolis, Minn. This invention is an improvement in lubricating axles for vehicles and relates more particularly to axles embodying a wooden axle-tree, provided with an axle skein. The skein is cored out to provide a lubricating passage



IMPROVED AXLE LUBRICATOR.

that communicates, at the inner end, with a grease cup. The passage leads to an opening midway of the journal which is thereby automatically lubricated.

SIGNALING DEVICE FOR AUTOMOBILES.—W. G. NASH, Daytona, Florida. It is the custom for automobilists to give a signal when they are about to stop or make a turn, so as to prevent collisions with following vehicles. As an improvement on the usual



SIGNALING DEVICE FOR AUTOMOBILES.

method of giving these signals by hand, Mr. Nash provides an automobile with a signaling device placed at the rear of the machine, and another close to the driver, both of which are operated by a hand lever. This signal may be illuminated so as to be visible at night.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

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AND EACH BEARING THAT DATE

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PATENTS

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PHOTOGRAPHING LIVING INSECTS.

(*Continued from page 477.*)

insects may be gathered and brought home to be examined and photographed at leisure.

Among these are the strange vegetable growths, caused by insects, which are called galls. These galls vary enormously in form. Indeed, almost every kind of gall-forming insect is associated with a particular and characteristic plant distortion. The reader will be familiar with many of the oak tree galls, such as the so-called "oak-apple," the "spangles" and "buttons;" also with the well-known "robin's pincushion" of the wild rose bushes. A photograph of this gall would splendidly and instructively illustrate the wealth of detail gained by using a black background. The same subject photographed before a white or pale-colored background would, almost inevitably, be more or less shadowy and indistinct. It is a comparatively easy matter to take a progressive set of photographs illustrating the life cycle of an insect, such as a butterfly, provided one can devote the necessary time and attention to the subject. By rearing caterpillars in captivity one may continually observe their changes, and take a picture whenever this seems desirable. For this purpose the writer has designed a special kind of cage which he has found admirably to answer the various requirements. It consists of a platform supported upon uprights in such a manner that a jar or pan filled with water may be placed beneath. In this way the stalks of the food-plant, passing through holes in the platform, are kept constantly moist; and long intervals may elapse between the giving of fresh food. This is a great gain; for—from the photographer's point of view—the less captive insects are disturbed the greater will be the chance of securing good and characteristic pictures.

The cover of the insect cage, or vivarium, is a wooden framework glazed on one side and on the other covered with stout gauze of tiffany, tightly stretched and tacked into place. This cover (which, of course, has no bottom) fits within a rectangular molding which is screwed upon the platform. Thus, whenever one wishes to take a photograph, the cover can be readily removed without the risk of exciting the insects by vibration.

The annexed photographs will enable the reader to comprehend the foregoing description. It only remains to add that these insect cases may be easily constructed from old wooden boxes at an insignificant cost.

That the photography of insects calls for unlimited patience need scarcely be emphasized. This fact will be at once apparent to anyone that contemplates taking a progressive series of pictures illustrating insect metamorphosis; for one can never tell exactly when a given form-change is going to occur. True, experience will prove of great assistance. One learns, for example, that certain changes of form or color foreshadow certain events in an insect's life; also, that certain species of insects commonly—though not invariably—undergo their visible metamorphoses at certain hours of the day. Even so, to secure a series of photographs showing from first to last the transformation of a caterpillar into a chrysalis, or of a chrysalis into a butterfly, necessitates many hours of close watching on the part of the worker. Nothing is more aggravating after three or four hours of watching than to loose the initial picture of one's series simply—because one turned aside for a moment—perhaps to take refreshment. There is no royal road to success in photographing living insects. One has to keep's one's eyes constantly fixed upon the "subject" until, in Nature's own time, the opportunity occurs for setting the camera to work.

In this particular class of insect photography—that is, the taking of progressive series—it is important to work in a good light, as the exposures must, of necessity, be brief. Of course the exposures may be made by means of flashlight; but the results obtained by this method are unsatisfactory on account of the heavy shadows and other less noticeable defects. If the day be fine and calm, the best place to work in is a sheltered corner of a garden—arranging one's insect cage on a table, and having all necessary apparatus at hand. Several of the photographs which illustrate this article were taken in this way. But in windy weather one must work within a studio or glass-house; and if reasonable care and forethought are exercised, very good results will be obtained.

In conclusion, I would add that it is quite possible, by means of a special magnifying lens screwed in front of the ordinary lens of the camera, to obtain very satisfactory enlarged pictures of natural objects. This direct enlargement is far less troublesome than subsequently to magnify the small image on the negative by means of an enlarging lantern. As an example of the kind of picture which may be taken by means of a magnifier screwed in front of the lens I once made one of a fly caught by a leaf of the long-leaved sundew plant. I had the plant growing under observation in my window, and one morning the unfortunate insect was grasped by one of the leaves, which ultimately "sucked its blood." The fly was alive when photographed, and struggled courageously from time to time. But by watching and waiting it was found possible to make the necessary exposure during an interval when its movements had temporarily ceased. Possibly this last picture may seem a cruel one to some of my readers. But to such I would say that when we study Nature's way we are not at liberty to pick and choose. We cannot comprehend the full significance of all that we see; but we are justified in believing (to quote the words of a great poet) "that all which we behold is full of blessing."

THE LARGEST SHIP: THE "EUROPA."

(*Continued from page 481.*)

A special squash court will be built in connection with the gymnasium. Nearby will be found a large swimming pool and completely equipped Turkish and Roman baths, presided over by skillful attendants.

The "Europa" will be ventilated throughout by a new system. She has no ventilator rising above her decks, and her long, unbroken deck incidentally gives her a very trim and shipshape appearance. Air will be forced to the lowermost decks by powerful air pumps. Every part of the great ship will be thus supplied with currents of pure air at the proper temperature.

The most powerful wireless telegraph apparatus ever carried to sea will be set up on the "Europa." The unusual height of her masts will make it possible to transmit or receive messages at any point on the Atlantic Ocean, so that the "Europa" will always be in direct communication with land.

THE TENTH LEPINE EXHIBITION.

(*Continued from page 480.*)

less than 5 ounces and furnishes 1/25 horse-power, which suffices to propel the boat at the rate of 2½ miles per hour. The total weight of the boat, with its engine, boiler, alcohol lamp, and sufficient alcohol and water for a run of 20 minutes, is less than 25 ounces.

Hébert's aeroplane-parachute (Fig. 2) is not a toy, but a practical flying machine. It has a single sustaining surface which forms a convex roof, extending over the entire machine, with the exception of the propellers, and which performs the function of a parachute when the machine falls in consequence of the stopping of the motor. Another peculiarity of this aeroplane is that it flies

(*Continued on page 489.*)

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FOR days of normal activities, normal diet supplies sufficient nerve and tissue nutrient. But with modern high-pressure business and strenuous social duties it is well-nigh impossible to keep demand *down* to normal and supply *up* to normal.

Our present mode of living induces nervous indigestion and similar disorders, which deprive Nature of her full quota of nourishment from the food we eat—she needs assistance in recreating nervous energy and bodily tissue.

That's why thousands of men and women—whose nervous health has at one time or other suffered, include at every meal

Sanatogen
THE FOOD-TONIC

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SIR GILBERT PARKER
The popular Canadian novelist:
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BLANCHE BATES
The famous Frohman star, says:
"In recommending Sanatogen as a body and nerve builder, I do so knowing that it has been of great help to me during periods of extreme nervousness and I shall always use it."

HARRISON FISHER
The well-known artist, says:
"I have used Sanatogen since the first of the year a find it a wonderful tonic. I am recommending it to my overworked friends."

DAVID BELASCO
The eminent dramatic author, says:
"It gives me pleasure to let you know the wonderfully beneficial results I have experienced from the use of your Sanatogen. It has a most invigorating effect upon the nerves and I heartily recommend it to all those who, like myself, are obliged to overwork. After my personal experience I can readily vouch for its recuperating qualities."

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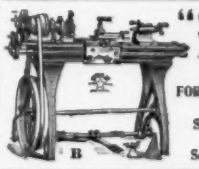

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Canadian patents may now be obtained by the inventors for any of the inventions named in the foregoing list. For terms and further particulars address Munn & Co., Inc., 361 Broadway, New York.

(Continued from page 487.)

lengthwise, and has a propeller at each end. The length is about thrice the width. Lateral stability is assured by suspending the car, which contains the greater part of the weight, at a distance below the sustaining surface equal to 1½ or 2 times the width of the latter. For the purpose of maintaining longitudinal stability the sustaining surface is hinged to the frame of four stiff tubes to which the car is attached, so that either end can be elevated and the other end depressed by pulling a cord. In consequence of the depth of the car below the sustaining surface the center of gravity can be shifted appreciably toward the bow or stern by a very slight inclination. The bow has a tendency to dip, owing to its tendency to convex form. This tendency is counteracted by placing beneath the bow a sort of air trap or pocket, having only one or two small openings, which sustains the sinking bow in the manner of a parachute. Two orifices near the top of the convex sustaining surface, which can be arranged to open and shut either automatically or by pulling cords, make it possible to descend without inclining the surface. The dimensions of the model shown at the exhibition were one-tenth those of a practical aeroplane. A silver medal was awarded to the inventor.

Another inventor deserves mention for his attempt to start an aeroplane on its flight without running over the ground on wheels. He employed rotary wings which are extended to raise the machine vertically, but which, unfortunately, do not appear to perform their function with complete success. When a practical solution of this problem has been found, the aviator will be able to start almost anywhere and to land on any open space which is large enough to contain his machine.

The department of aeronautics also included many little flying toys, bearing fanciful names and more or less amusing and instructive. Passing to other toys, we find a great variety of "novelties" which have a familiar appearance. Inventors of toys move in well-trodden paths and their new productions are usually variations on old themes, made timely by current events or the caprice of fashion. Boucheron's huntsman (Fig. 6) is a case in point. A toy animal, hit by a projectile from a spring gun, runs along a semi-circular track and falls into a pit that is unmasked by pressing a rubber bulb at the critical moment.

The same inventor received the first prize for the group of toys shown in Fig. 3, including the hand-cart man, the gingerbread eaters, the acrobat performing on a chair, and the slide-trombone players. These toys are, so to speak, reminiscences of the automata called "Bonshommes Martin," which are so popular in Paris and which may be seen in the collections of the Conservatoire des Arts et Métiers, beside the mechanical masterpieces of Vaucanson! A very comical effect, however, is produced by the gingerbread eaters, one of whom is forced to relinquish the cake by dislocating his jaw with the hand.

The Georges toy billiard table (Fig. 5) has a number of holes arranged in two circular arcs which bound the fields assigned to the two players. The ball is struck by an arm which turns on a pivot and which is moved by pushing it with a short rod. Each player endeavors to drive the ball into his opponent's holes and prevent it from entering his own. When the ball is driven into a hole it falls through into a numbered groove in a drawer beneath. If a player drives a ball into one of his own holes his opponent scores double.

Oberlander's ski runner (Fig. 7) may be used either as a social game or for the amusement of children. It is a wooden construction representing a steep mountain path intersected by crevasses, which the mountaineer, coasting down the slope on skis, is compelled to leap. On reaching the bottom of the slope, the puppet strikes and opens a box containing a number of balls, which fall upon a table beneath, where they knock down pins or roll into numbered holes.

Several interesting small inventions and models of machines were shown, including the Mangin automatic running gear for wagons; the Combes universal tool, which may be employed as a vise, an anvil, a grindstone, a forge, a drill or a pipe-wrench, and which attracts attention by its remarkable simplicity; the Sellier sweeping machine, which found many purchasers; and the automobile fire ladder, invented by Sergeant Ferrand, of the Paris fire department. Among the most popular exhibits were the ammunition wagon and other small wooden models carved with a knife by the artist Fagolle, and the clock representing the temple of Jerusalem, for which M. Pirotte received a diploma of honor.

SACKS, BAGS, BOXES, ETC., AND ESCAPES THEREFROM.

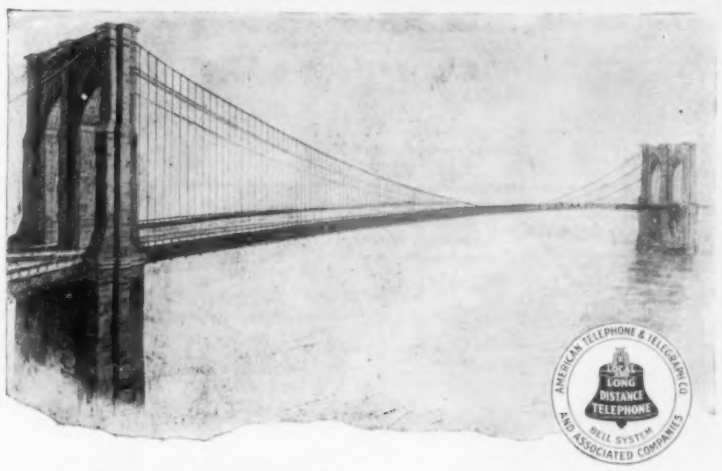
(Continued from page 482.)

front of him, he moves the circular strip of metal round until a small opening in one of its sides corresponds to the pinhead of the spring catch. Then, by inserting a small steel blade, which the performer has concealed about him, he can draw back the pin and push up the circular opening in the lid of the can. The illustrations will make this clear. After he has stepped out of the can, the lid may be snapped to, and the spring catch will make all secure. In order to heighten the effect, the performer may, if desired, allow himself to be handcuffed before being placed in the can. Needless to say, in this case, the performer releases himself first from the cuffs, then from the can; or *vice versa*.

Some years ago, an original performer introduced a method of escape from a packing case, the lid of which was nailed up by a committee selected from the audience. The packing case was in this instance the performer's own, and stood upon the stage from the beginning of the act. Examination was first invited, and, this having been completed, the performer was placed in the packing case and the lid nailed down. After a few moments, however, the performer made his escape, while his assistant (who stood beside the case, when the screen was placed in front of him) was found inside of it.

An examination of the illustration (Fig. 7) will make the method of escape clear. The packing case really consists of four parts: (1) the four sides seemingly nailed together; (2) the top, also devoid of trickery; (3) the bottom to which (4) the wooden corners or battens are nailed—these supposedly belonging to the *sides* of the box. The four sides are then slipped into these corner strips and screwed to them *from the inside* with a couple of screws, well oiled. A number of dummy nails (i. e., nails which have been filed off a little below the head) are driven into the battens from the outside, giving the case a very solid and genuine appearance. The performer is now placed in the case, and the lid is nailed down. While this is being done, the performer extracts a screw driver and an electric lamp from his pockets, and proceeds to unscrew the screws which fasten the sides of the case to the corner slats or battens. This done, the instant the screen is placed in front of the case, the performer has only to push upward upon the lid of the case, when the lid and sides slide upward, enabling the performer to make his escape, and his assistant to enter at the same time. The assistant finds and utilizes the screw driver and the pocket lamp, which the performer has left behind him, and by their aid again screws the sides of the packing case securely to the corner battens. This done, the case is again ready for any amount of examination.

Not content with this, however, some



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still more ingenious performer went further, and devised a method of release from *any* packing case—one which had been supplied by a local merchant, and which could be constructed and nailed together upon the stage! No confederates were employed, and the case and nailing were in every way genuine. Nevertheless, the performer succeeded in making his escape.

The "fake" or piece of apparatus depicted in the illustration (Fig. 6) is the means whereby the performer effects his release. When unscrewed into its various sections, it may be concealed about the performer's clothing and remain undetected. (The packing case must be of rather soft wood, and about half a dozen air holes should be bored into the box, allowing the performer sufficient ventilation while the "escape" is being effected.) If the boards are one inch thick, the nails provided should be about two inches long, these giving the appearance of quite large nails, yet they can sink but one inch into the sides of the case, after they have been driven through the lid. After the performer is in the case and the screen has been placed in front, he extracts from his clothing a pocket lamp and the various sections of his "fake," which he proceeds to screw together. The solid center of the "fake" is provided with a double-thread screw, and the central rod is also provided with a screw, so that when the central portion is turned around and around, by means of handles which can be pulled out, the ends are forced outward, and a great deal of pressure can be applied (when the "fake" is stood upright, as shown in the illustration) against the lid of the packing case. In this manner the nails are slowly forced out, and the lid of the case being opened in this manner, the performer steps out and again conceals his "fake" about his person. He then pushes the nails back into their original holes (which may be quite easily done, as a rule) and the packing case is ready for examination. This, well worked, is one of the most puzzling illusions that has been presented to the public in many years, and its originator—whoever he may be—deserves much credit for his ingenuity.

Hunters of Rock Crystal.

One of the most dangerous and most laborious of callings is that of the rock crystal searcher.

It has attained much greater importance since rock crystal came to be used in optical work.

For generations past, the Swiss have pursued this business in their mountains. Rock crystal, which is pure silica, or crystallized quartz, is found on a large scale, of varying fineness and coloring, sometimes separate, sometimes in deposits.

The crystal hunters are known as "strahler" and the crystal as "strahlen" (luminous rays).

The outfit of a "strahler" consists of a bar of iron, four feet long and hooked at the end, of a shovel, a mattock, a strong rope, and a leather bag.

Thus equipped, he sets out in the morning to search for the rock crystal. He is almost always alone, so that he may not have to share his booty. For whole hours he climbs and climbs, mounting the sides of the rocks on ledges a few inches wide, over yawning abysses and frightful precipices.

Finally, he perceives a vein of quartz, which he makes an effort to reach. The nails on his shoes no longer hold on the sloping ground. As soon as he begins to walk, the ground breaks away; he cannot get ahead.

Patiently, without a word of vexation, without an angry gesture, because the "strahler" has learned that these are useless, he returns to seek another route, for there is no open road that leads to these inhospitable regions; it is necessary to pick a convenient place for each step in advance, and very often, the

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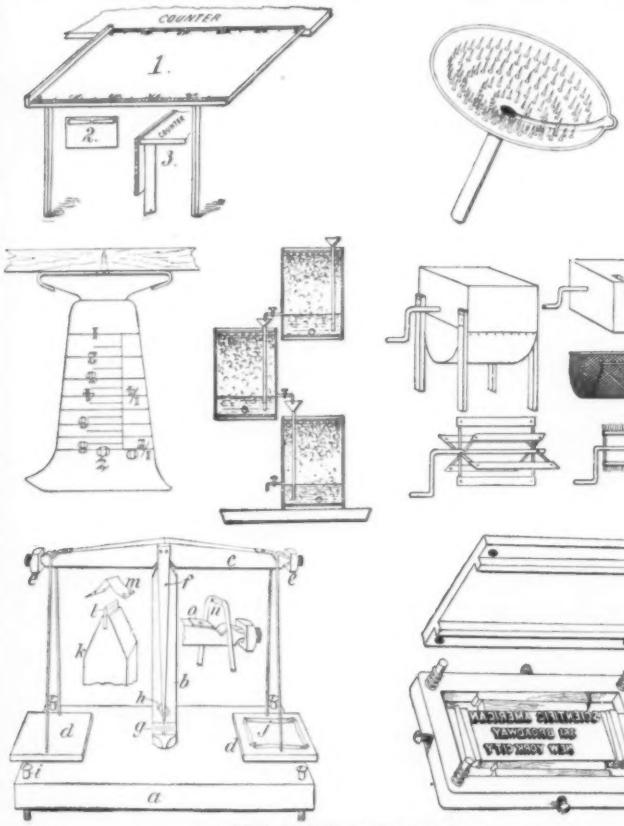

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roughness not being sufficient for progress, the crystal hunter has to cut, with his mattock, climbing steps in the rock.

Finally, the vein is reached; he follows it, striking with his hammer. The sound returned indicates to his skilled ear the existence of a cavern, a geode or pocket, which are the names given in Switzerland to the hollows where the crystals are found, attached to the sides, or detached and mingled with sand.

Last year, a strahler, on St. Gothard, made a lucky discovery of large crysta s.

A hundred yards below the line of eternal snow, he saw a vein of quartz about forty yards long and fifteen yards wide. But on this day it was impossible to reach the vein, for, at the moment of its discovery, darkness began to envelop the mountain.

He passed the night in a hut, a half hour's journey away. Unfortunately, in the morning, in place of the bright sunshine for which he had hoped, thick clouds of fog covered the sky. He had to beat a retreat, and return as quickly as possible to the valley.

The winter came, and the treasure he had caught a glimpse of did not allow him a moment's rest; he counted the days that must pass before the return of spring and the melting of the snow.

Finally, the day so long awaited arrived, and one fine morning, he took up his route, with one of his colleagues. Having relocated the vein, they exploded a mine to open the hollow and penetrate into the secret cavern, at the risk of being crushed by the falling rocks.

In short, they finished by collecting more than three hundred quintals of crystal, which they had all the trouble in the world to carry away, at the expense of several successive journeys. And this, for the one who had been so lucky as to first discover this vein, was a veritable little fortune, which he employed in setting up a well-equipped inn.

Rock crystal is also found in the Dauphiné, in Piedmont, and imbedded in Carrara marble. East India too furnishes fine specimens, likewise North America. This material was highly prized in former times and worked up, as it still is sometimes, into seals, cups, and vases with finely executed gold mountings. Owing to its hardness, it is less liable to be scratched than glass, and therefore extensively used for lenses of spectacles, etc.

An extensive piece of electric railroad work is under discussion in Paris, and if carried out it will cost no less than $20,000,000. This relates to running electric trains upon the suburban system of railroad lines which center at the St. Lazare railroad depot. As the depot lies in the heart of the town and the tracks run in a cutting below the ground level while crossing the city, the space for tracks is very much limited, so that within a recent period there has resulted a great congestion of traffic. It will be remembered that the West railroad lines which start from this depot were taken over by the government not long since. The engineers are now looking for a solution of the problem, and it is proposed to use electric trains exclusively for the suburban lines. In this way the trains can be run at very short intervals, at least upon the inner part of the system. At present the depot serves for an annual transit of 70,000,000 passengers, or 50,000,000 for the suburbs, and the traffic is increasing at the rate of a million per annum. The engineers wish to divide the suburban region into three zones, and to run separate trains for each zone, so that the trains for the outer zone would not stop when in the inner district, and *vice versa*. At the same time the through tracks would be kept entirely separate from the suburban tracks, as is done in England. For the inner zone it is proposed to run light trains at 3-minute intervals, as on the Paris subway. The St. Lazare depot yard would need to be entirely remodeled, and this work would cost about $2,000,000.

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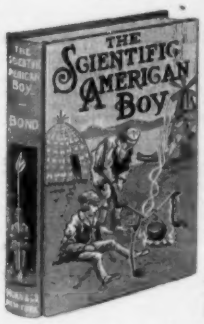

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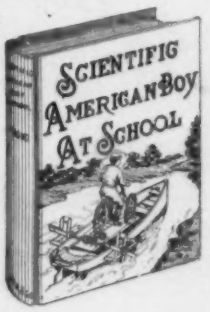

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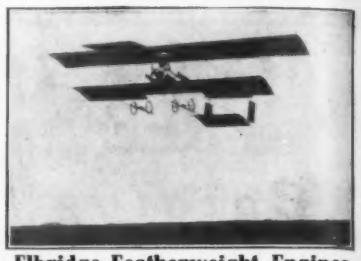

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